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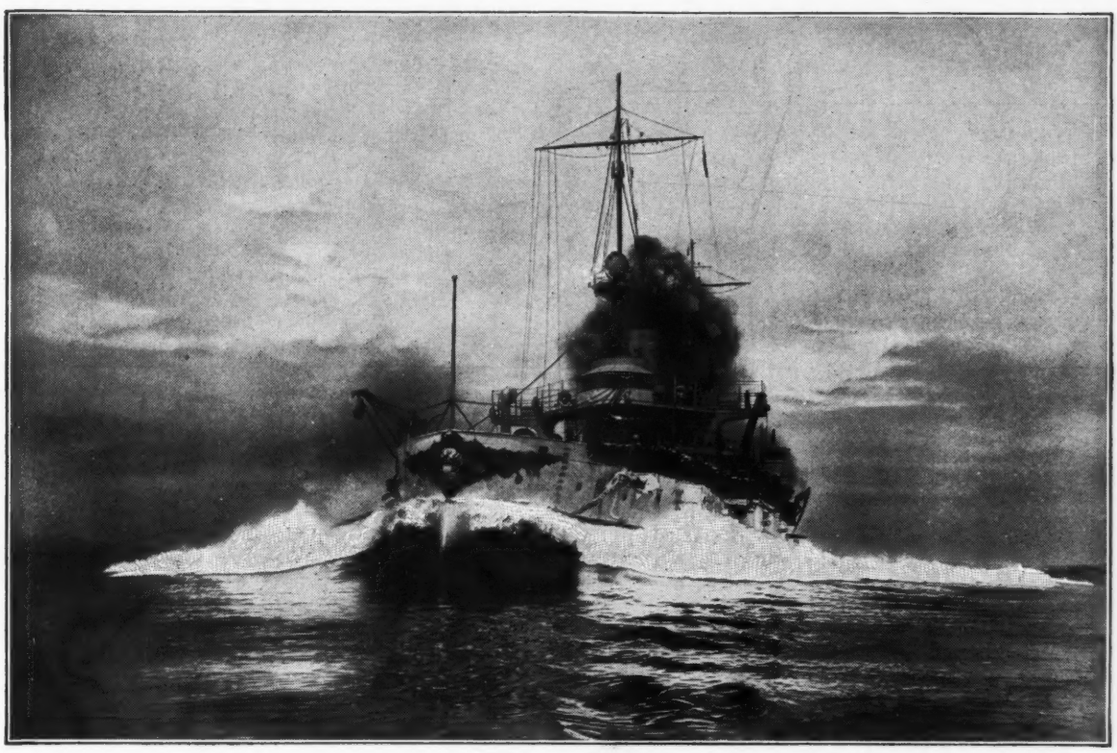

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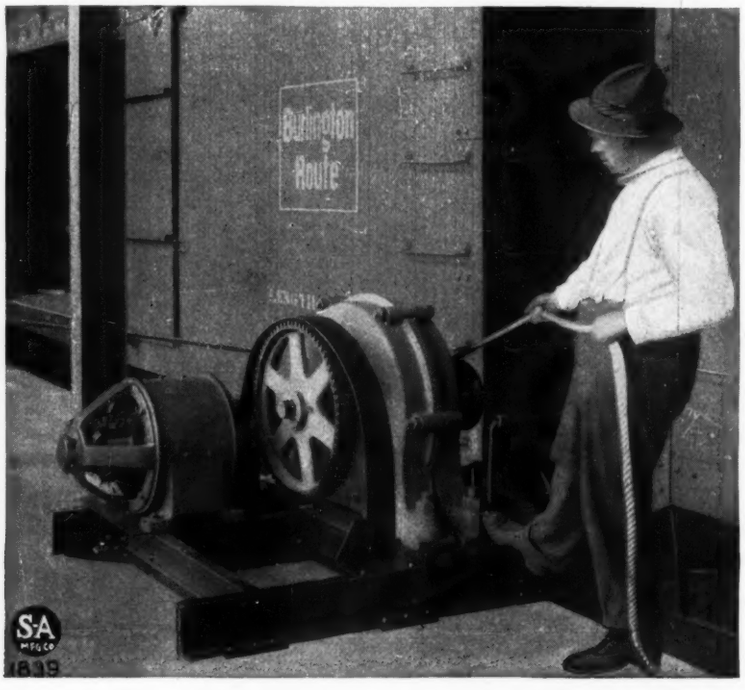

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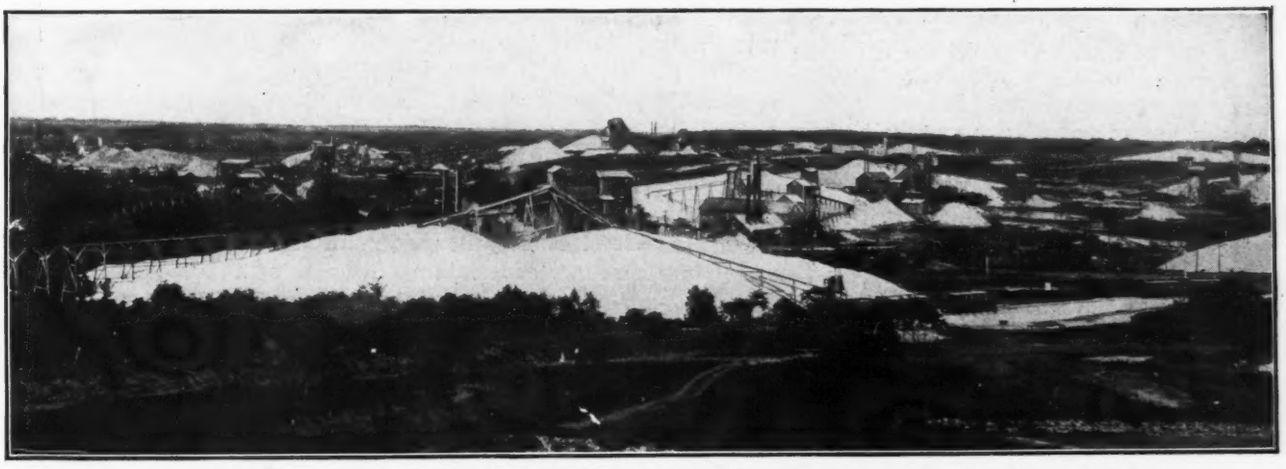
The Mining Districts of Joplin and Southeast Missouri—I

By H. W. KITSON

The lower Mississippi Valley has developed the greatest zinc and lead industry in the world. The Ozark uplift rises from the plains a dome of sedimentaries from Cambrian to Carboniferous age deeply eroded to a plateau exposing a basement core of granite in the St. Francois Mountains. The lead deposits of Southeast Missouri occur in an outcropping Cambrian dolomite, the zinc and lead of Joplin in a higher Mississippian limestone. The region acquired by the Louisiana Purchase was settled by an agricultural people, and with the exception of a few surface workings most of the mines were discovered while sinking for water.

COMPARATIVELY few mining men in the United States, and especially in the West, have visited the country's greatest zinc and lead districts—Joplin and Southeast Missouri. Until recently there has been a dearth of technical literature from either district, which may be attributed in part to the unconventional practice in mining and milling at Joplin, and to the policy of nonpublicity of the part of the companies operating in the Southeast Missouri area. It is, therefore, not surprising that, with the exception of those engineers whose activities have at some time centered in one or the other of these sections, so little is generally known concerning either. To many Joplin is but a familiar name associated with lead and zinc somewhere in Missouri, and the Southeast Missouri lead district is either confused with it or is altogether unknown. Those members of the American Institute of Mining Engineers who attended the recent meeting of that body in St. Louis, and who for the first time visited the coal, zinc, lead, oil and gas fields of Missouri, Illinois, Kansas and Oklahoma, and read the technical papers and other literature descriptive of the region presented at the meetings, will agree that the present and future wealth of the lower Mississippi Valley is beyond any previous conception they may have formed in regard to the variety, quantity and extent of the region's mineral resources.

It is the purpose of this series of articles to present first a long-distance view of the entire area of the lower Mississippi Valley, later viewing the Joplin and then the Southeast Missouri districts at closer range and describing each in turn, first as a whole, and then subsequently in its various phases. Technical papers descriptive of the ores, geology, mining and milling of both districts have been published in recent bulletins of the American Institute of Mining Engineers and deal with various technical problems with a thoroughness that need not be undertaken in the present article, which aims only to incorporate all that has been written in a general descriptive manner with information



GENERAL VIEW OF JOPLIN DISTRICT BETWEEN WEBB CITY AND ORONOGO, MO.

Note—The first of a series of articles dealing with the region of the Ozark uplift, to be followed by papers on mining and milling in Joplin and on the practice in Southeast Missouri.

gathered during a recent visit both to Joplin and Southeast Missouri. The miner from the mountainous West will wonder at the smoothness of topography, the absence of "blowouts" and evidence of past mountain-making and ore-making igneous activity. He will marvel that a country can have a cultivated field on the surface and a mine below, and will be puzzled to learn that he cannot stake out a mining claim on land that is more valuable for mining than for agricultural purposes. The millman will note with astonishment the countless number of small mills dotting the landscape so profusely in the vicinity of Joplin and Webb City, each with its conical tailings pile, said to carry from 0.5 to 1% zinc, and collectively appearing like huge sand dunes on a desert, and until he has seen the cost sheets and realized the economic situation as it actually exists, he may think he has found a rare field for betterment of practice both in mining methods and in milling. But in this instance hastily formed conclusions are likely to be misleading.

The World's Largest Zinc and Lead Districts

The value of the mineral products of the lower Mississippi Valley, a region centering in the State of Missouri and extending into the adjacent parts of Illinois, Indiana, Kentucky, Tennessee, Arkansas, Oklahoma and Kansas, amounted in 1916 to nearly six hundred million dollars.[1] The district is the largest zinc and lead producer in the world, accounting respectively for one-third and one-seventh of the total of each. In oil Oklahoma and Kansas produced 40% of the total in the United States; and from the entire section there was a large production of bituminous coking and non-coking coal, and some semi-bituminous and semi-anthracite of high grade. In addition the field produces barite, bauxite, cement, clay, fluorspar, gypsum, lime, manganese, oilstone, phosphate rock, pyrite and salt, and also limited quantities of cobalt, copper, nickel, gems and precious stones, sand and gravel, stone, tripoli, and tungsten. Iron ores are not produced extensively at present, but there are large known deposits in Kentucky, Tennessee and Missouri. Other valuable deposits known to exist are asphalt, feldspar, fullers earth and pumice. The development of vast mineral resources in metals and fuel, the equally great agricultural yield of wheat, corn, cotton, fruit and other products of the soil, the abundant rainfall, moderate climate and natural facilities for railway construction and river transportation have built up great industrial and distributing centers at St. Louis and Kansas City, smelteries and refineries in Kansas, Oklahoma, Illinois and Missouri, and numerous mining and manufacturing towns throughout the entire region.

The two main sources of lead and zinc in the lower Mississippi Valley are in the Southeast Missouri section and in the Joplin district covering southwest Missouri, northeast Oklahoma and southeast Kansas. Productive areas of lesser importance are in northern Arkansas, southeast Illinois, northwest Kentucky and throughout the central part of Missouri. The disseminated lead deposits of the Southeast Missouri district lie in St. Francois and Madison counties, and to a lesser extent in Washington and St. Genevieve counties, and are concentrated chiefly within a radius of approximately five miles centering at Flat River and encircling Bonne Terre on the north, Leadwood on the west and Fredericktown on the southeast. The principal mining activities are at Bonne Terre, Rivermines, Leadwood, Flat River, Elvins, St. Francois, and Desloge. The zinc-lead district of Joplin in southwest Missouri covers a roughly elliptical area, with the long axis approximately east and west, commencing in the vicinity of Springfield, Mo., and extending westward through Joplin and Webb City, and into Galena and Baxter Springs, Kan., and Picher, Commerce and Miami, Okla.

A Mining Region of Smooth Topography

The Ozark uplift centers in southern Missouri, rising gently from the plains as an elliptical plateau which extends on the south into northern Arkansas, on the west into the extreme eastern parts of Oklahoma and Kansas and on the northeast into western Illinois. The ascent from the plains on the west, north and northeast is gradual, attaining an average elevation of from 800 to 1500 ft. and rising east of its center in the St. Francois Mountains to 1800 ft. On the south the plateau

TAILINGS PILE OF FEDERAL LEAD CO.'S MILL NO. 3, FLAT RIVER, MO.

attains its greatest height at 2000 ft., forming the Boston Mountains, which range along the north side of the Arkansas River, an abrupt southern termination of the plateau region. The topography west of Springfield, Mo., and south of Joplin varies from somewhat broken hilly country to level and occasionally gently rolling prairie. The contrast of this smooth, nearly level country in the Joplin zinc district to the rugged mountainous mining districts of the West is marked. None of the mountain-making eruptives of the Rockies or southwest deserts are evident. Outcrops are rare and gossan is unknown. On the contrary, most of the soil is under cultivation even in the heart of the districts of active mining and in many cases both industries thrive on the same tract. The surface drainage channels of the lower Mississippi Valley are toward that river, but the smaller tributaries on the western slope of the Ozarks course southwestward into the Arkansas.

Ozark Plateau an Eroded Dome of Sedimentaries

The St. Francois Mountains of Madison, Iron and St. Francois counties rise from the plateau near its eastern edge, a structural center of outcropping granite and porphyry of pre-Cambrian age—a basement underlying the entire region—sloping with a gradual flattening of dip radially from this eminence under its domed

[1]Advance figures published at the St. Louis meeting of the American Institute of Mining Engineers by permission of the U. S. Geological Survey.

overburden of later sedimentaries[2]. An east-west section of the Ozarks is shown in Fig. 4. In the Southeast Missouri disseminated lead district, in the vicinity of Bonne Terre, the granite underlies sedimentaries at a depth of 650 ft. below the surface. Northwest, at Sullivan, Franklin County, the granite lies at a depth of 1200 ft.; at Rolla, Phelps County, at a depth of 1800 ft.; at Carthage, in the Joplin district, at a depth of 1850 ft., and at Kansas City and St. Louis, respectively, at 2350 and 3550 ft. The contact between the granite and the overlying Cambrian sandstone is unconformable and represents a period of sedimentation subsequent to an era of erosion during which the granite surface was deeply carved by drainage systems. This sandstone formation, known as the La Motte, has an average thickness of 200 ft. It is conglomeratic at the base and merges with alternate layers of sandstone and

comparatively little faulting or folding has occurred within the region. The exposures of granite in the St. Francois Mountains are the result of faulting, with a subsidence of the later surrounding formations, some of which faulting is evident in the Bonne Terre-Flat River district. In northern Arkansas faulting is associated with ore deposits and in the Joplin district also some faulting has occurred.

There are two important horizons of zinc and lead mineralization. The ore deposits of the Southeast Missouri disseminated lead district occur in the older of these two—the Bonne Terre dolomite of Cambrian age. In the Joplin zinc-lead district the ore deposits occur in the cherty limestone of the Boone formation, of the later Mississippian age. Both of these formations outcrop in their respective districts, and, although widely separated geographically as well as strati-

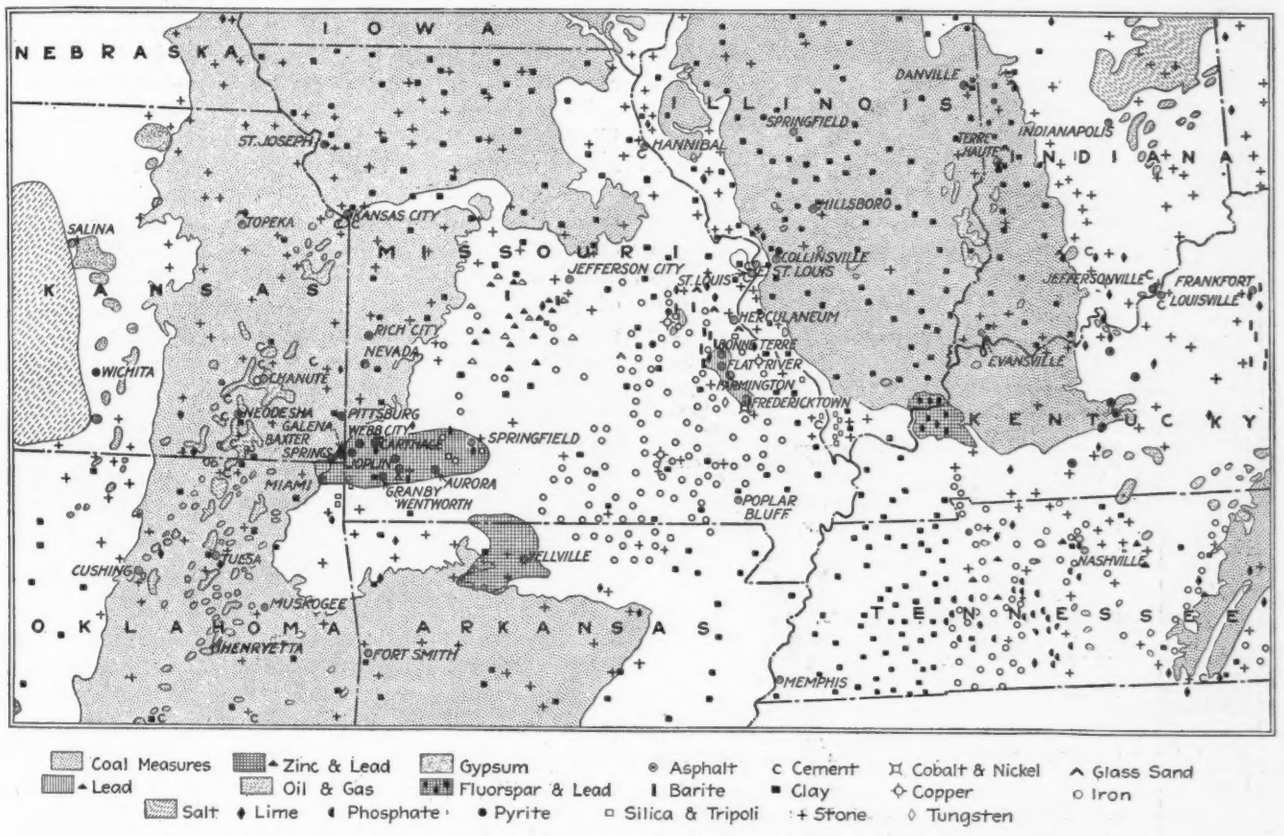


FIG. 1. AREAL DISTRIBUTION OF MINERAL RESOURCES IN THE LOWER MISSISSIPPI VALLEY

dolomite into the overlying Bonne Terre dolomite which outcrops at the surface in the Southeast Missouri lead district and constitutes the ore-bearing formation. The Bonne Terre dolomite is of Cambrian age, has a thickness of 350 ft. and rests conformably upon the La Motte sandstone. The higher formations of the Cambro-Ordivician period have been removed by erosion from the immediate vicinity of the district and outcrop further out from the granite area in the order shown in the columnar section in Fig. 2. The still higher Silurian, Devonian, Mississippian and Pennsylvanian formations outcrop throughout the Ozark region in roughly concentric succession about the Cambrian, as shown in the areal map in Fig. 3. With two exceptions

graphically, the ore deposits bear marks of similarity in mode of occurrence and genetic origin.

Some mineralization has taken place close to the upper contact of the La Motte sandstone near the ore deposits in the Bonne Terre dolomite of the Southeast Missouri district; and in the Joplin district the Chester (sandstones and limestones) of the upper Mississippian is the horizon of the first discovered shallow lead-zinc deposits. An intervening period of erosion removed most of the Chester formation prior to the succeeding unconformable deposition of Cherokee sandstone and shale of early Pennsylvanian age. Isolated remnants of the Chester are to be found scattered throughout the Joplin district and upper Boone area of outcrop, deposited in ancient sink holes in the Boone which protected the later formation during the ensuing period of erosion.

[2]"Geology and Mineral Deposits of the Ozark Region," by H. A. Buehler, Bulletin, A. I. M. E., October, 1917.

A similar condition of deposition in sink holes and depressions of erosion has protected the Cherokee of the Pennsylvanian from the present erosion, and with the exception of these outlying remnants the Chester and Cherokee do not constitute the surface rock except at the extreme western border of the Oklahoma-Kansas portions of the Joplin district. Some mineralization also occurs in the Pennsylvanian in connection with the sink-hole deposits near their contact with orebodies in the Mississippian.

Other ore deposits of lesser importance occur in the intervening formations between the Bonne Terre and the Boone. Bordering the Bonne Terre area in the Southeast Missouri district are the successive Davis

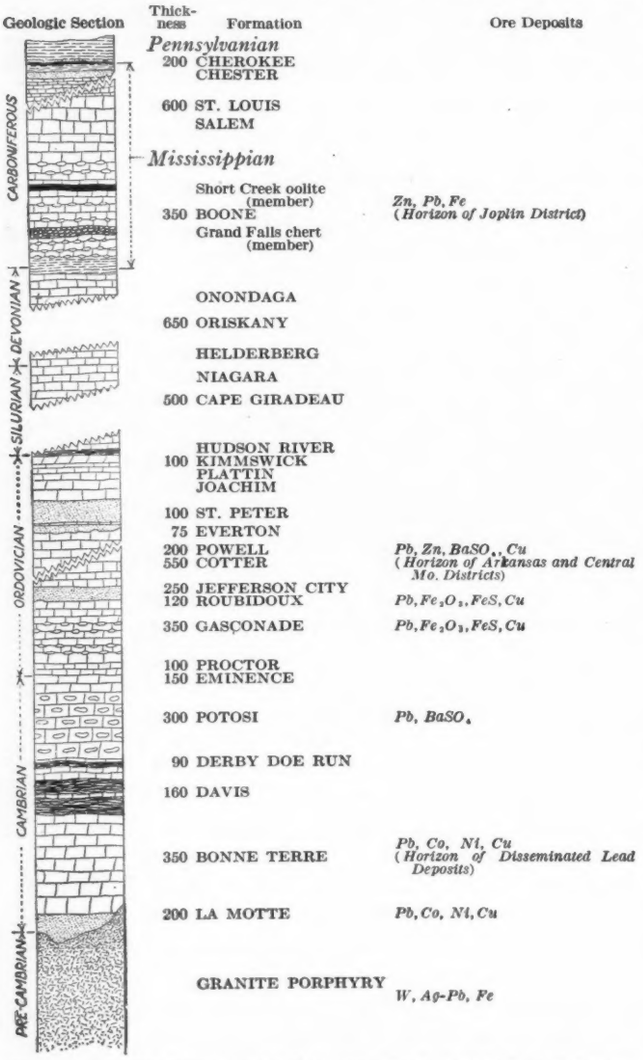


FIG. 2. GEOLOGIC COLUMN OF THE OZARK REGION—AFTER BUEHLER

shale, Derby and Doe Run formations and the Potosi cherty dolomite of Cambrian age. In Washington and Jefferson counties galena associated with barite occurs in joint planes and horizontal seams in this heavy-bedded gray dolomite. The beds of chert interstratified with the Potosi dolomite are the lowest in order of stratification in the Ozark region. The irregularity and shallowness of these ore deposits have not produced any mines of consequence. Shallow veins of the fissure type containing galena and barite occur in Franklin County. Deposits of lead, zinc and barite occur in the Jefferson City dolomite of Ordovician age and have been productive in the north-central part of Missouri. In northern Arkansas lead and zinc have been mined from the Cotter and Powell formations of the same age. In St. Genevieve County these formations have produced some copper. In the vicinity of Fredericktown, southeast of the Flat River district, cobalt copper and nickel and some disseminated lead occur in the La Motte sandstone and lower Bonne Terre. Carbonates of copper have been mined in Shannon County, occurring on the contact of the sedimentaries and the granite.

Veins of argentiferous galena occur in the pre-Cambrian granite, in which mines were opened up in the early days. These veins are now being worked on a small scale for tungsten, which occurs in association with the galena as huebnerite. Specular-iron ore has been extensively produced from the pre-Cambrian porphyry in the Iron Mountain and Pilot Knob districts. Hematite and limonite ores also occur in Crawford County, east Missouri and Arkansas, and barite is produced from Washington and Jefferson counties in large amounts.

Throughout this vast area of mineralization little or no metamorphism of the sedimentaries has taken place. Igneous activity has been confined to but two known intrusions of an age later than the sedimentaries. Small basic dikes occur as intrusives in the granite and porphyry in the St. Francois Mountains, and in Camden County the sedimentaries are cut by a dike of pegmatitic character. The granite and rhyolite porphyry belong to the oldest series in the region and are thought to have formed part of one magma and to be of Laurentian age. The veins occurring in the pre-Cambrian igneous rocks are undoubtedly depositions resulting from emanation of gases and solutions of an expiring period of volcanism, and analyses of the older rocks show that they contain minute quantities of both lead and zinc.

Ore Deposits Derived from Surface Solutions

In the light of later theories on ore deposition, the deposits of lead and zinc in the sedimentaries of the Ozark region are attributed to a deposition in channels from waters descending from the surface containing lead and zinc in solution, metals derived from the eroded portions of the older rocks and precipitated both in open cavities and by metasomatic replacement of the limestone. Calcite, dolomite and chert of a secondary character are the common associated gangue minerals in the Joplin and Southeast Missouri districts, and their presence is evidence of the action of cold descending carbonated solutions of an acid character. The prevalence of an extensive artesian underground circulation accounts for the migration of such solutions over considerable distances governed by the impervious beds and the erosion over a wide area of drainage of all the stratified formations across their dip.[3] Such action is shown diagrammatically in Fig. 5. In the absence of alteration products and the metamorphism of the rocks that invariably accompanies the genesis of orebodies formed from solutions of plutonic origin, the possibility that such a source could account for the deposits of zinc and lead in the Joplin and Southeast Missouri districts seems remote.

[3]C. E. Siebenhal, "Bull. 606," U. S. Geol. Surv.

Unlike most mining sections of the West, where public land bearing valuable minerals is given prior right in the mining laws of the United States over agricultural claims, the Missouri mining districts have been parceled into tracts of 160 acres and the region was taken up by an agricultural people long before its value as mineral land was discovered. This was the case in the Joplin district of southwest Missouri and southeast Kansas. The mining land in northwest Oklahoma was originally known as Indian Territory and remains in the ownership of the Indians of that section. In southeast Missouri the land is partly surveyed into sections, but the eastern part is cut up into irregular areas, a relic of the old land-grant system.

The earliest records of mining in Missouri date back to the French occupation in the eighteenth century. The Mississippi was discovered by Spaniards under De Soto in 1541, but abandoned by them for the greater riches in gold of Mexico and Peru. In 1682 La Salle came down the Mississippi from the upper valley, at that time being explored and settled by the French, and, arriving at the mouth of this river, took possession of the whole territory drained by the Mississippi and its tributaries in the name of King Louis XIV of

OUTCROP OF BONNE TERRE DOLOMITE AT RIVERMINES, MO.

France and to it he gave the name of Louisiana. This vast acquisition embraced more than half the North American continent, including, as it did, all the territory north of the Gulf of Mexico from the Rockies on the west to the Alleghanies on the east and extending northward through Canada to Hudson Bay. Toward the end of the series of wars that took place between England and France, beginning in 1689 and ending with the Treaty of Paris in 1763, mining in Missouri according to E. R. Buckley was started in Washington County at Mine à Renault in 1725. Operations at Mine à Gebore were conducted on a small scale between 1742 and 1762. In 1767 Pierre Laclede founded a trading post on the Mississippi River and named it in honor of Louis XV, and in 1775 it had become a well-known fur-trading depot. At the Treaty of Paris, France ceded all her territory in Canadian North America to England, and the territory south of Canada was ceded to Spain. The French who remained in the territory, however, evidently continued their mining operations, as Mine à Layne was discovered in 1795, Mine à Manteo on Big River in 1799, and Mine La Plate about the same period. Winslow estimates that during this century St. Francois County produced about 1000 tons and Washington County 19,000 tons of lead ore. Mine à Burton was discovered about 1763 and "Old Mines" dates as far back as the earliest discovery and has been worked intermittently up to present time. Mine La Motte is among the oldest in the district and is being worked today.

The Napoleonic wars returned the Lousiana province to France in 1801, and two years later this great territory of about 900,000 square miles was acquired by the United States, during the Jefferson administration, for $15,000,000. In 1804 Capt. Stoddard, of the U. S. Army, succeeded the Spanish commandant at St. Louis, and the region was organized into the Territory of Louisiana, and St. Louis made the capital. From this territory the states of Louisiana, Arkansas, Missouri, Iowa, Kansas, Nebraska, Wyoming, Montana, North and South Dakota and parts of Minnesota, Colorado and Oklahoma were formed. In 1812 Louisiana became a state, and the name of the territory was changed to the Missouri Territory. Missouri came into the Union as a slave state under the Missouri Compromise in 1820. The railroad land-grant system originated in 1835, and the transcontinental roads received vast tracts of land aggregating millions of acres along their routes. The first railroad in the state was opened with 38 miles of track in 1852. By the Preëmption Act of 1841 any genuine settler could take up 160 acres of public land and make his payments on long and easy terms at a rate fixed in 1862 of $1.25 per acre.

Joplin Ores Discovered by Accident

In the Joplin district the first-reported discovery was made by William Foster at Granby in 1850. This, like other succeeding discoveries, was made by accident in the course of well digging for water. Galena was the ore mined from the shallow deposits where shafts were first sunk. Small furnaces were soon after erected and lead bullion was hauled by wagon to Fort Smith, Ark., and transported by boat to New Orleans, New York and Boston. In 1856 Blow & Kennet started operations on a larger scale. Lands were leased and furnaces erected, and railroad construction started. The Civil War put a stop to development in 1861, but the mines were operated alternately by both sides during that period. Right after the war the Granby Mining and Smelting Co. was organized, the various interests combined and operations resumed. Galena and cerrusite were the first ores mined. Calamine and sphalerite were later recognized, and upon completion of the railroad to Granby, zinc ores were shipped.

For the first 30 years galena and calamine were the main ores of the district, but later sphalerite ores took the lead, with calamine second and galena third. The first modern concentrator was built in 1898, the ores up until that time having been concentrated in hand jigs.

The history of the district is one of spasmodic rushes and booms, followed by hasty production on a profitable if wasteful scale. The land, primarily agricultural, was largely settled by a farming people who knew little of mining. For a number of years Granby was the center of prospecting. Later, strikes were made by accident at Joplin and at Oronogo, at which points mining activitity became intense. Discoveries followed at

Webb City, again by accident, and another rush was made to this section, and such has been the development of the region from the beginning. Strike after strike was made, with intense exploitation in each section, until there became a scattered group of camps point to a probable repetition of such expansion in other parts of the district. It is possible that the ground between Duenweg and Granby, under the stimulus of efficient prospecting, may prove to be a continuous run of ore. The undeveloped stretch between Carthage

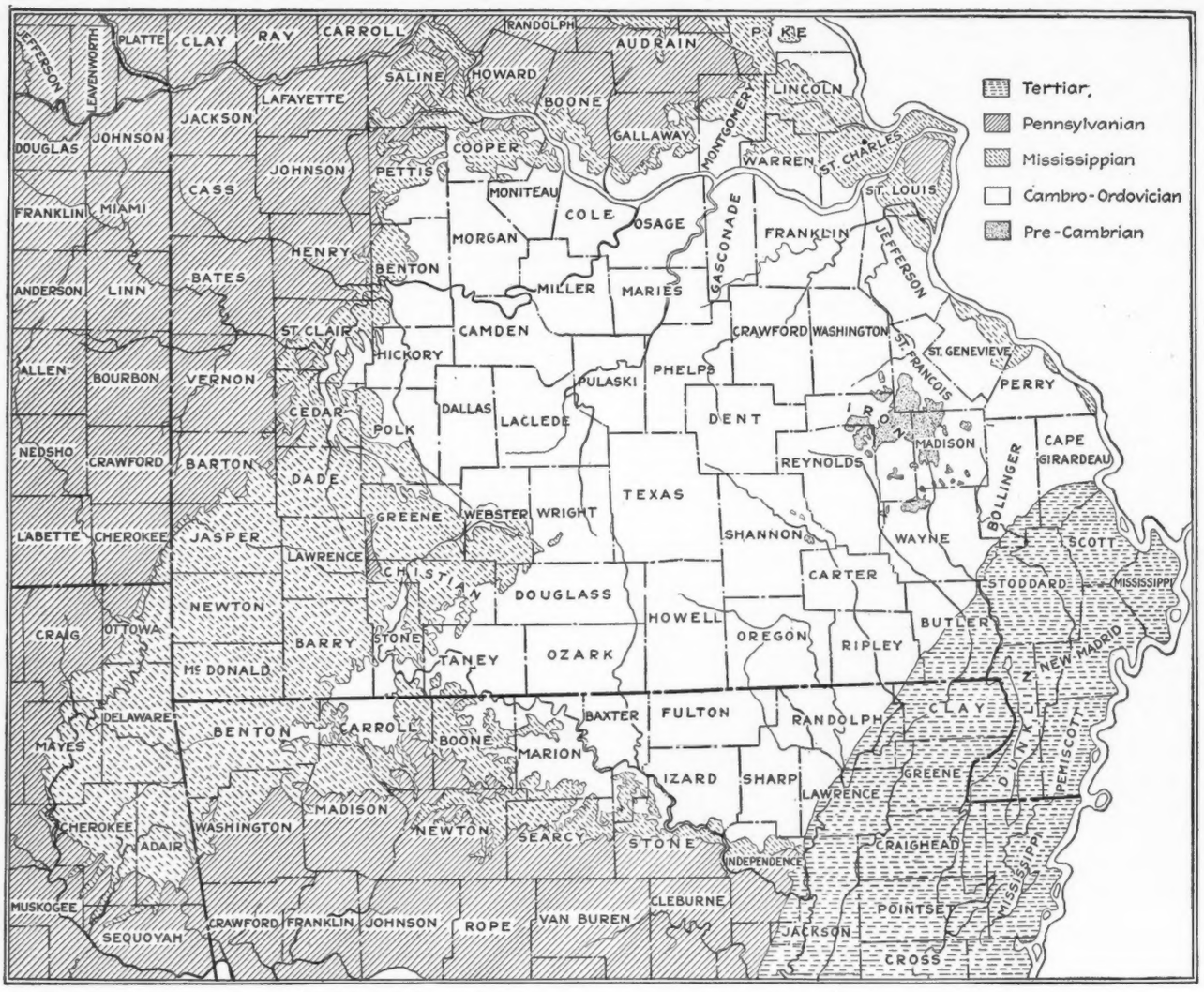


FIG. 3. GEOLOGICAL MAP OF THE OZARK REGION—AFTER BUEHLER

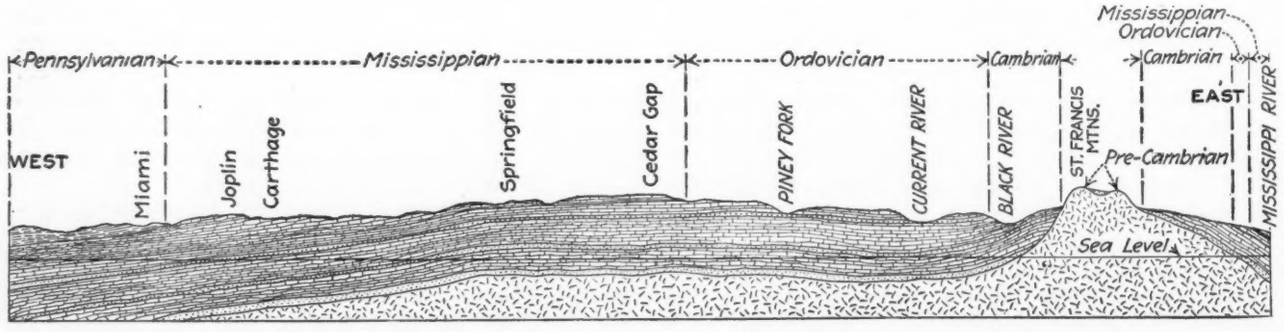


FIG. 4. GEOLOGICAL SECTION THROUGH JOPLIN AND SOUTHEAST MISSOURI—AFTER BUCKLEY

with Joplin as a center. Between most of the camps there are wide stretches undeveloped that may prove to be valuable mining ground. There are well-known instances where mining activities have linked together neighboring mining camps by the lateral extension of the orebodies, as from Oronogo on through to Duenweg, a stretch of seven miles, and more recent operations and Neck City forms another possibility for the future. The development of the district has progressed steadily since the sinking of the first shallow shaft for lead. Types of each stage of progress in methods are still to be observed and the history of the area's development can be pieced together. Early exploitation was made on the grubstake plan, prospecting for the

shallow lead deposits at first and later the shallow zinc deposits. The mineral had to be free in character and amenable to hand picking, followed by hand jigging, in order to be profitable. Problems of concentration came with the exhaustion of the shallow deposits and the discovery of the deeper and lower grade orebodies. Out of all this the present milling practice was evolved, and its low cost of operation has made profitable the mining of ores producing as low as 2% of zinc concentrates. At present, however, many of the lower grade mines have been forced to close owing to the marked increase in wages and cost of supplies and the absence of a corresponding advance in the price of ores. This condition has stimulated prospecting in the newer fields of Oklahoma and Kansas, where ores of higher grade can be made to yield a better profit on the present market.

The earliest mining in the Southeast Missouri district proper was at Mine à Joe in 1801. These were shallow lead deposits in the tract later known as the Bogy Lead and Mining Co. and in 1887 purchased by the Desloge interests. Operations at the Pratt mine,

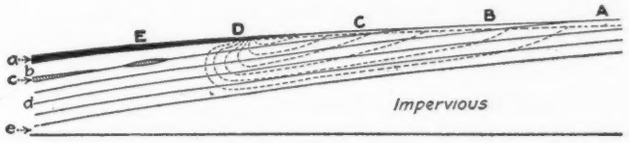


FIG. 5. DIAGRAM SHOWING OZARK ARTESIAN CIRCULATION—AFTER SIEBENTHAL

in the vicinity of Bonne Terre, started as early as 1820, but the disseminated ores were not discovered until 1864. Four years later the St. Joseph Lead Co. was organized and diamond drilling started in the Bonne Terre section. The company purchased the land from Anthony La Grave, a property previously owned by the Valle and Aubuchon families. The Doe Run company started in 1887, but has recently been merged with the St. Joseph Lead Co. The Federal Lead Co. began operations in the Flat River district in 1902, later acquiring the properties of the Irondale, Derby, Central and Field companies. The St. Louis Smelting and Refining Co. commenced in 1898 by purchasing the holdings of the Flat River Lead Company.

The region is well served by railroads connecting the productive districts with the smelting and marketing centers. West of the Mississippi the Kansas Southern Ry. runs from Kansas City to Port Arthur, Tex. It is the short line from Kansas City to the southeastern Kansas coal field and the Joplin zinc-lead district and traverses the coal-producing section of eastern Oklahoma and western Arkansas. The Missouri Pacific R.R. connects St. Louis and Kansas City, serving the coal fields of northwestern Missouri, passing through Barton County, Mo., Crawford and Cherokee counties, Kan., the Joplin-Webb City zinc-lead territory, and the oil and smelting districts of Kansas and Oklahoma. It also reaches through subsidiary lines the coal mines of Arkansas and the southeast Missouri lead district. The St. Louis-San Francisco Ry., known as the Frisco Lines, runs from St. Louis and Kansas City to the heart of the Pittsburgh, Kan., coal fields and the Joplin-Miami lead district, passing to the Tulsa and Glenn Poole, Okla., oil and gas country, and with four district lines to Texas handles a large mineral tonnage. The Frisco Lines also serve most of the smelteries.

In 1916 there was produced from the smelteries in the lower Mississippi Valley 512,000 tons of spelter, or 75% of the total production of the United States. Of this amount Kansas and Missouri smelteries produced 34%, Illinois 28%, Oklahoma 31% and Arkansas 7%. Natural gas in Kansas and Oklahoma has made this section desirable for the location of smelting plants of which there are 17 and 14 respectively. In Illinois there are 11 plants, in Missouri three, in Arkansas three and in Indiana one. Although the zinc content of the ores smelted varies considerably, the average production per retort per annum would probably be about four tons. One of the byproducts of zinc smelting is the manufacture of sulphuric acid from the waste fumes.

The lead smelteries of the region are situated close to the lead-producing districts and in 1916 yielded 236,000 tons of lead.[4] The principal smelteries for the southeast Missouri district are those of the St. Louis Smelting and Refining Co., at Collinsville, Ill.; the Federal Lead Co., at Federal, Ill.; the St. Joseph Lead Co., at Herculaneum, Mo., and the Desloge Consolidated Lead Co., at Desloge, Mo. The Eagle-Picher Lead Co., one of the largest pigment manufacturers in America, has plants at Joplin and Webb City, Missouri.

(*To be continued*)

Zinc Sulphide Made Phosphorescent Through Heat

Pure zinc sulphide prepared in various ways can be obtained in a phosphorescent condition by the use of heat, according to E. MacDougall, A. W. Stewart and R. Wright in *Chem. Soc. Trans.*, 1917, (abst. *Journ. Soc. Chem. Ind.*). Ordinary precipitated zinc sulphide shows no trace of phosphorescence. The addition of certain impurities has a marked effect in most cases, either inhibiting the phosphorescence, as in the case of iron, or altering the tint, as in the case of manganese. The presence of a chloride, either of zinc or other element, increases the phosphorescence. The factor which has the greatest influence, however, is the temperature to which the zinc sulphide is heated, and this may be varied within limits. A sample heated for a very short time to a high temperature has been found to give effects similar to those observed in another sample heated for a longer time at a lower temperature, provided that the latter is not lower than about 750° C. Washing, rubbing, or disturbance of the final product in any way tends to diminish its phosphorescent power.

The amorphous sulphide does not phosphoresce, nor does the purely crystalline sulphide show such good phosphorescence phenomena as samples which contain semi-crystalline material. Specimens made from zinc salts free from chlorides do not show such brilliant phosphorescence as those produced in the presence of chlorides. It is suggested that when the impure sulphide is heated, a surface film of zinc chloride is produced; and this film, on cooling, may contract and procure a strained condition of the material within the film. When manganese is present, however, it is difficult to avoid the conclusion that some chemical phenomenon must be concerned.

[4] "The Mineral Industry," 1916.

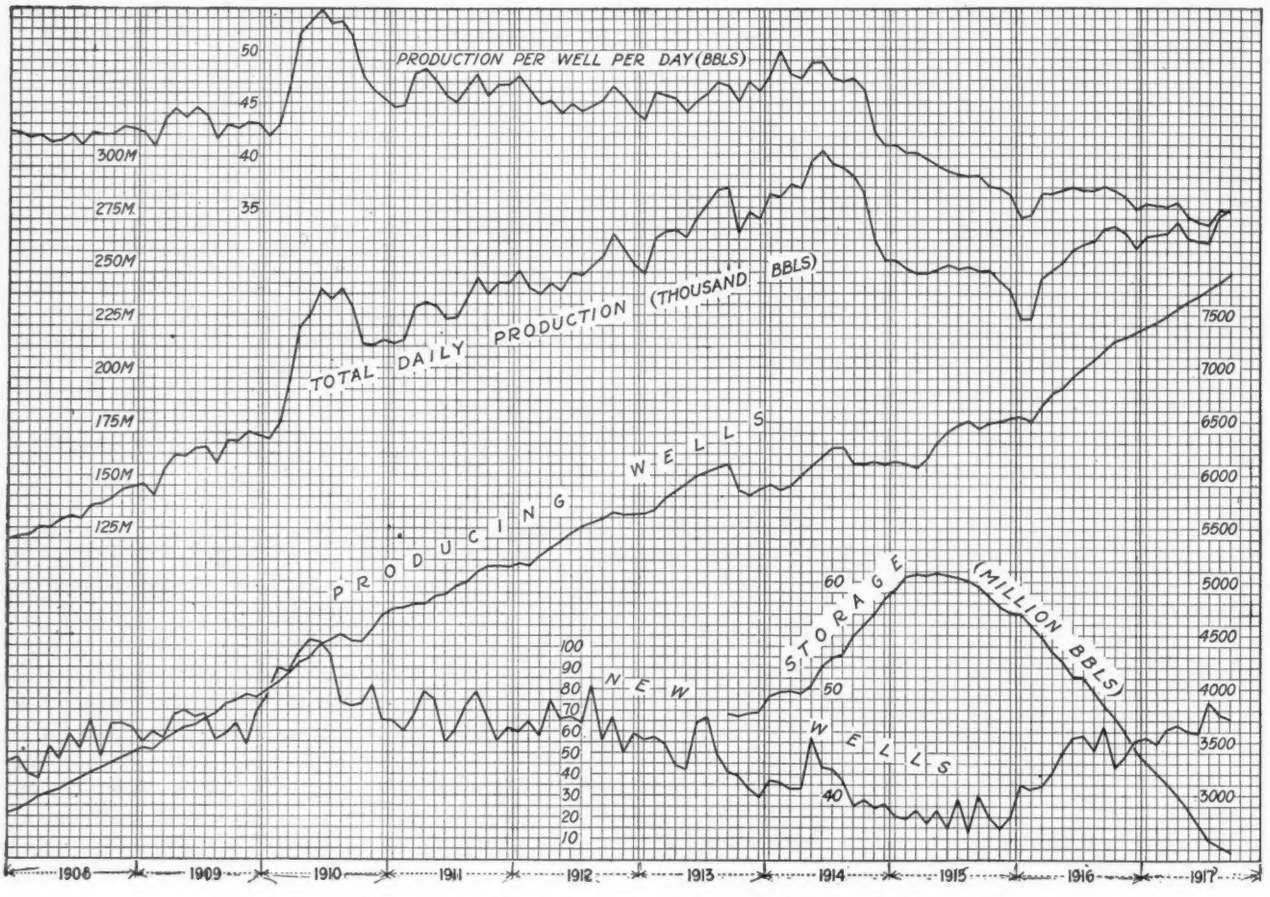
Chart of California Oil Production

By Lewis H. Eddy*

The extraordinary movements in the production of the California oil fields from the year 1908 to 1917, inclusive, and the critical storage movement from September, 1913, to September, 1917, inclusive, are indicated in the chart presented herewith, which was compiled by the oil and gas department of the State Mining Bureau from data furnished by the Standard Oil Co. The original chart carries the record back to 1903. The four important features of production are: (*a*) the number of producing wells; (*b*) new wells completed; (*c*) total daily production; (*d*) production per well per day. There was a general advance movement of all features with some sharp changes during the period embraced in the years 1903 to 1907 inclusive; but no noteworthy variation except a considerable advance in production per well per day in 1903 and 1905.

The accompanying chart embraces the gusher period of 1910, when the increase in producing wells remained normal, and the number of new wells completed, the total daily production, and that per well per day showed phenomenal increase. From January, 1903, to September, 1917, there was a total advance in the number of producing wells from 2300 to 7900 and an increase in total daily production of more than 230,000 bbl. The highest point of daily production per well was reached in June, 1910. The increase in daily per-well production has not been constant, but the total increase to September, 1917, is approximately 14 bbl. per well per day. The lowest number of new wells completed in one month was five, in March, 1905, and the highest was 103, in May, and 102, in June, 1910, the only months when the record reached the 100-point mark.

The storage record begins with September, 1913. It is interesting to note the close relation between the increased daily production and increased storage in the last quarter of 1913 and the first half of 1914, and the similar relation in decline of both features in the last half of 1915, compared to the sharp, steady and almost constant shrinkage in storage from January, 1916, to September, 1917, and general increase in daily production during the latter period. In the early days of the war the marketing of oil was seriously threatened and fear of overproduction followed a decline in prices at the well of approximately 10c. per bbl. in the last half of 1914. The increased production in 1916 and 1917 has been unequal to the increased demand of the market, so the storage stocks continue to decline, while the Government withholds oil lands that should be reopened to development and production to avoid a famine in fuel oil and the products of the refineries.



GRAPHIC CHART OF CALIFORNIA OIL PRODUCTION FROM 1908 TO 1917

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Manganese Deposits in West Africa of the Fanti Mines, Ltd., and on the extension of the deposits on Dagwin Trust have been worked this year as energetically as shipping conditions would permit, according to the report of Consolidated Gold Fields of South Africa, the controlling company. Up to the end of August about 22,000 tons had been exported.

Considerations in the Selection and Use of Hoisting Ropes

Contributory factors of stress on hoisting ropes are numerous and complicated, and little actual data have been obtained. To the ordinary stress from the load there must be considered the number of bends over sheaves and drums, the compression of the inner layers on a drum and the periods of stress and relief. Various types of rope are in use and the selection should be made with the coöperation of rope manufacturers.

AT THE recent congress of the National Safety Council in New York hoisting ropes were the subject of considerable discussion at the meeting of the mining section of that organization; the presence of a number of prominent mining and manufacturing engineers brought forth comments of technical importance regarding the selection of ropes for hoisting. H. C. Behr,[1] whose experience on the Rand and whose writings have made him an authority on the subject, contributed some notes of interest in which he said:

The question of stresses in hoisting ropes is always important and M. H. Sigafoos merits our approval for bringing up the subject in his paper[2]. The bending stress referred to by Mr. Sigafoos is determined by the ordinary formula for the stress in a bar bent to the curvature of the drum and is directly proportional to the diameter of the wire and inversely proportional to that of the drum or sheave. This ratio is multiplied by the proper modulus of elasticity. If the ordinary modulus for tension is used, the formula becomes a safe one to adopt and gives a stress outside of what probably is that actually straining the material of the rope.

Determination of Bending Stress

The lasting qualities of wire ropes indicate that a smaller value of the modulus should be used for determining the stress due to bending. Professor Hrabak in his treatise on wire ropes "Die Drahtseile" (which I think has not been translated from the German) has brought out this point strongly and Professor Bach, to whom Hrabak also refers, deals with the subject in the eighth edition of his "Maschinen Elemente." Bach comes to the conclusion, in view of the endurance of ropes in practice, that the modulus of elasticity, and therefore the stress in the wires in a rope due to bending, cannot be nearly as high as the modulus for tension in a loaded straight rope. By arguments based on general practice and its results he arrives at a modulus about ⅔ of that for tension. He admits the lack of sufficient logical ground for his deduction, but calls attention to experiments which he made on the tension modulus of elasticity of a loaded straight rope, which modulus he states happens to be approximately the same as that resulting from his calculation. He submits the arguments merely for want of a more logical explanation. Among other things, he points out a minor inconsistency in the ordinary method of calculating the stress due to bending over a drum in that such method does not take account of what must obviously be a gradual transition from the uniformly distributed stress in the wire just before winding on the drum and where it is still straight, to the condition in the immediately adjacent section where the unequal distribution of stress due to curvature is supposed to exist. To assume a sudden jump in the stress would obviously be unreasonable. Bach, however, seems to forget that the wire is not curved suddenly to the diameter where it winds on, but curves in a gradually increasing manner over a transition curve tangent at one end to the straight wire and at the other to the circle of the drum, and in such a manner the stresses obviously vary in a gradual manner over the length of the transition curve. The question of bending stresses on the wires of a rope has not yet been answered in a satisfactory manner by assuming a lower modulus of elasticity for the wire based upon elongation tests of the rope. Records of such tests give a modulus of only a fraction of the 28,000,000 generally assumed for the wire.

Professor Hrabak takes Bach's value of ⅔ E. Hrabak, who I believe was also director of the mines at Pribram, Bohemia, contends, however, that this value applies only in the case of new ropes and that it increases with the age of the rope as the elasticity decreases and states that it will be about double the initial value, or ¾ E, toward the end of the life of the rope. Hrabak's arguments seem to me inconclusive, but so far no one has supplied proof theoretical or experimental to show to what extent the bending stress in wires composing a rope is reduced below that in a single wire simply curved to the radius of the drum, and to be on the safe side I have therefore always figured my bending stress with the ordinary modulus for tension.

Question of Rope Stress Complicated

An interesting point in connection with the question of the stress in a rope where it is wound on a drum is that the first layer of rope compresses the drum slightly and reduces its diameter. The next coil will compress it more and gradually the preceding layers are relieved of the tensional stress that was on the rope originally. The bending stress would still remain, so that the rope that is actually wound on the drum endures less stress than it had when it was just winding on, and the maximum stress would occur practically only for an instant. In addition to this there is the friction of the rope on the drum, which also affects the stress. The whole question of determining the stresses of the rope is complicated and we have to acknowledge that we know little about it. I do not know whether or not experiments in this field would give useful results, but at any rate, the subject is worthy of the attention of engineers generally, and should be further investigated.

[1]Consulting mechanical engineer, 2 Rector St., New York

[2]"History of Wire Hoisting Ropes with Notes on Factors of Safety," "Eng. and Min. Journ.," Nov. 10, 1917.

Practical experience with ropes often induces surprise and wonder that a certain rope has given way, and sometimes equal surprise that a rope did not give way sooner under the bending stresses supposed to be brought on the wire by a small diameter of the sheave or drum. Take, for example, the case of some ropes that have been in general use, like the so-called patent strand type, the flat wide core wire of which must be subject to considerably greater stresses, due to bending, than the ordinary round wire. I have heard that some of these ropes have lasted well, although I have never used any of them. The lock-coil ropes, also, have wires of considerably larger dimensions and the stresses on the outer fibers must be considerably greater than in the ordinary construction of rope, like those with 6 x 19 wire strands. The results of observations with that kind of rope would be of value. The problem of rope stresses is a difficult one and it is difficult to get comparative results, as there are so many factors which enter to influence the life of a rope.

Factor of Safety Six in the Transvaal

Mr. Sigafoos mentioned the factor of safety of five on wire ropes, based merely on the standard load which the rope is expected to carry. That is probably suitable for most cases. I have used ropes with such factors for hoisting rock from a depth of 4200 feet and in some cases they lasted 22 months. The mining law of the Transvaal, however, demands that ropes shall not be used for hoisting men when the factor of safety shall have become less than six. Ropes must initially have a much greater safety factor, because of the inevitable deterioration. Most ropes used for hoisting rock are used frequently for handling men, being also used for hoisting timbers. One never knows what the load is, and it may be excessive. The worst load is usually a load of drill steel.

The Transvaal law states that the load of men, assuming a man to weigh 150 lb. (which is generally accepted as the official weight) should never exceed 85% of the maximum load the cable will be subjected to in operation for other purposes. That law was found to be a great hardship. It unnecessarily limited the number of men per trip in the case of a depth of 4200 ft. One of our shafts extended to that depth and if the law had been enforced we could not have hoisted men on apparatus that we used for the handling of material.

Frequent Inspection Imperative

We had one serious accident with a flat rope in one of our mines. Flat ropes are not generally used in the Transvaal, and it was a case of neglect by the resident engineer of the mine in not examining the rope carefully. In this case the shaft was about 2100 ft. deep and the rope broke at about one-third, or 600 or 700 ft. from the end. About 40 natives and one white man were precipitated to the bottom and killed. The accident made a great stir and was really the start of more vigorous government legislation by the new authorities—the British had not long before taken hold at that time—on safety devices and ropes.

This rope had been worn through by the back slipping of the rope on the sheave, the engine driver having been in the habit of hoisting fast close up to the surface so that the brakes had to be used excessively to bring the engines to a stop at the proper point. The sheaves were large in diameter, so that the bending stresses were slight. The construction of the sheaves was also partly responsible for the wear on the rope, as they were made with unnecessarily heavy rims. If the arms had been made heavier so as to support a lighter rim, the moment of inertia would have been less and there would thus have been less tendency for spinning when retarding by the brake. In some cases a smaller sheave may be advisable to obtain a smaller moment of inertia.

Proper inspection would have disclosed the wear of the rope and its cause. This, however, was neglected. The government was lenient, however, and did not press the matter.

The accident led to a close investigation of the old laws. The British government did not want to show hostility to the industry, and consulted a large number of engineers before advocating the various laws that were finally enacted. One excellent regulation specified that at every mine there should be kept a special rope book in which everything in the life history of the rope had to be entered, the book being required to be open to the government inspector at all times.

The regulations prescribed the periods of capping ropes, and how much should be capped. A daily inspection was required—it was usually a cursory one, of course, but it might show additional broken wires, and thus keep the mine rope inspector in touch with the condition of the rope from day to day. There was a more rigorous weekly inspection, if I remember rightly, and a thorough monthly inspection.

Deteriorative Effects of Mounting from Layer to Layer

Local deterioration has been found to occur where ropes mount from the first to the second layer. We tried to eliminate this by a construction of drum described in the report of the Transvaal Government Commission on ropes and safety catches. The suggestion was my own, but I must say that the result was not satisfactory; the plan adopted did not seem to reduce the shock on the rope when mounting it from the first layer to the second by the groove being raised. The matter of mounting the rope from a first to a second, or from a second to a third layer is, however, a problem worthy of serious consideration by the mining section of the National Safety Council. It is today still very much of a problem.

One other point was brought out by the government inspector of machinery. He came to the conclusion that long ropes might be allowed to have a considerably lower factor of safety than short ropes; that is, for the upper end of the rope, where it winds on the drum. His theoretical investigation is much in line with the later findings of German authorities. The reports on ropes for the Dortmund district show that with moderate depth most accidents to ropes occur about ⅓ up the length of the rope from the point of its attachment to the cage or skip.

On the Rand, we had a deep winding problem, and in order to get a sufficient safety factor to meet the views of the government for the handling of men we had to adopt tapered ropes. Tapered ropes have been in use, I think, for 40 years in the mines of Bohemia. A number of such ropes have been constructed more recently for collieries in Belgium. We found no diffi-

culty with these ropes; they behaved just like ordinary ropes, and, for great depths, their use makes possible economy in the construction of the hoist; hence this may be smaller. A smaller rope requires less space, less storage on the drum. Also, weight is less and the cost lower because there is considerably less weight of rope for the same strength than when a rope of uniform cylindrical shape is used.

Selecting ropes for great depths is always a serious problem, and my way of treating the matter has been to discuss the situation with a number of rope manufacturers before making out the specifications. Ropes for great depths, cylindrical or otherwise, cannot be handed down from the shelf or kept in storage. The material and size of the wires must be thoroughly considered. I have frequently sent out a preliminary specification to obtain comment from manufacturers and get their views. For ordinary ropes and smaller ropes it is generally possible to secure ample margins, and the selection, even by the resident engineer at the mine, presents no great difficulty. Coöperation between the makers and users of ropes is most important in this respect, because they can supplement one anothers' experience, and it will certainly lead to a better understanding of the question and of elements of safety, which is the thing desired in this connection. I have been studying wire ropes for a long time, but the more I see of them the less I feel that I know about them. I would like to get the views of others on a great many points, and I hope the discussion will lead to a better understanding of the wire-rope problem.

Galvanizing on Ropes Does Not Last

I have never used galvanized ropes, but in upcast shafts, where there is acid vapor or acid water dropping from the timber, they have been used by some companies. I do not know to what extent galvanizing affects the strength of a rope. Sherardizing with zinc dust has been employed on ropes, but whether it has led to any better results than the ordinary galvanizing I do not know. I would also like to know whether lock-coil ropes have been used for hoisting in this country, and what is the greatest ultimate strength of the material that has been used in the strands of flat rope. For stitching of these a mild material must be employed. I have seen some flat ropes in which the strands lasted a long time, but stitching had to be carried on almost continuously. One rope would be taken off and restitched and another was put on, and it kept a crew of rope men constantly at work. At the old Mexican Union shaft on the Comstock, about the year 1880, before it closed down, ropes about ¾-in. thick for a depth of about 3000 ft. were in use, two spare ropes being always undergoing resewing. The mine water was acid. The wear of the stitching occurs particularly at the outer edges.

On the question of Lang's lay and ordinary lay, there are a great many different opinions. The ordinary lay is claimed by many to be too lively and likely to kink. Some of our ropes on the Rand were of peculiar construction, being made of 18 strands of 7 wires each and the strands were laid up 12 around six around one hemp core. They were good ropes, but had a tendency to kink and had to be handled cautiously when they were first wound on the drum.

As to the ultimate strength of steel used in ropes, we have generally, for long ropes, not hesitated to specify 120 long tons—most British manufacturers list their ropes in long tons—to the square inch, but we have had ropes submitted to us of material having an ultimate strength of 140 long tons.

In making specifications for a rope it is obviously proper to state as many as possible of the conditions under which the rope is to operate in the mine—the sizes of the drums and sheaves, the number of bends, the lateral deviation, the conditions making for corrosion, what treatment the rope may be subject to and whether it is a vertical or inclined rope. The hoisting speed will have a considerable influence on strains that are thrown on the rope. The method of fastening to the cages or skips forms a subject almost in itself.

Revival of the Zinc Industry in Russian Poland

According to the *Berliner Börsen Zeitung* of Sept. 1, in an article translated in a U. S. Consular Report, the zinc mines of Olkusz, Poland, which for a long time have been under water, are now in a condition to commence producing. The zinc-ore deposits at Trias, not far from Olkusz, which are well known to the zinc industry, made it possible for the zinc smelteries of Bendzin and Dombrowa to be established.

The zinc mines at Boleslaw, near Sosnowice, which belong to the Sosnowice Mining and Smelting Co., before the war produced an annual average of about 10,000 tons of calamine and over 2000 tons of calamine with galena. The Ulysses zinc mines at Tlukienka near Dombrowa, which belong to the Franco-Russian Company, are now being managed by the Germans. These mines have an average annual production of 40,000 tons of calamine and 12,000 tons of calamine with galena. Altogether before the war the Polish zinc mines produced 50,000 tons of calamine and 14,000 tons of calamine with galena per year.

The zinc mines of Poland have been connected by rail with the railroad at Bukowno. This branch line is about two miles in length. The zinc ore is smelted in the various plants near and in Dombrowa, particularly the Paulinen smeltery near Zagorze, which belongs to the Sosnowice Mining and Smelting Co.; the Konstantin, near Dombrowa, which formerly belonged to the Franco-Russian Company, and the Bendzin smeltery, near the town of that name, which formerly belonged to the Société Minière of Dombrowa. The number of workmen now employed in the Paulinen smeltery is over 450; the Konstantin employs about 200 and the Bendzin over 200 men.

Before the war a total of about 9000 tons of spelter was produced in Poland each year on the average. The present production, which is far below this figure, is exported for the most part to Austria. The market for zinc is satisfactory, which is fortunate in view of the increased cost of operating the mines and smelteries.

Arizona Mines Pay 57% of the Taxes in that state, according to the report of the Arizona chapter of the American Mining Congress. This figure is exclusive of the taxes paid on their stores and other property. In addition the industry is paying enormous total tribute in the form of taxes levied by the Federal Government for the conduct of the war.

Development of Reverberatory Practice at Copper Cliff, Ont.

By CHARLES F. MASON*

A history of the development of side-wall feeding of the Canadian Copper Co.'s reverberatory matting furnace, with some details of the changes in the furnace construction that have not been previously brought out.

IN VIEW of the widespread adoption in the last few years of side-wall feeding in conjunction with coal-dust firing of reverberatory matting furnaces, some additional details of the development of that method at the Canadian Copper Co.'s plant at Copper Cliff, Ont., should be of interest. At the time this plant was started none of the men in charge had had previous experience with the system, and they may therefore claim to be pioneers in this economical practice.

Slight Alterations in Standard Furnaces

Two reverberatory furnaces were built in 1910-11, and one was started in December, 1911. They were intended to smelt several years' accumulation of blast-furnace flue dust, current flue dust and the excess of green-ore fines over that which was used in bed roasting for the blast furnaces. One furnace has sufficed for this work since the fall of 1913, so a description of the changes in that one only is necessary. It was 112 x 19 ft. and of conventional design, with the exception of the bottom, which was an inverted arch of 9-in. magnesite brick laid on concrete with a foundation of poured slag, and the "bridge wall" (the name still clings), which was solid, except for five 8-in. round openings about 2 ft. above the bath line. These openings were for the powdered-coal burners, which could deliver up to 100 tons of pulverized coal in 24 hours. The flue continued in a straight line with the center of the furnace, having only a slight rise at the throat—designed to eliminate as far as possible corners for coal ash to deposit in. It has not been altered except for a slight enlargement at the throat increasing the cross-sectional area from 32 to 40 sq.ft. Skimming was, and still is, done at a point 15 ft. from the throat, on either side, and the tapholes were 25 ft. from the burner end.

The first serious trouble to develop was the choking of the throat by accumulation of coal ash, which was semi-liquid when deposited and consequently difficult to remove. The congestion became so bad that the furnace had to be shut down for a continually lengthening period every day, in order to cool the clinker to a point where it could be broken off by hand. It must have been a student of homeopathy who suggested that this frequent cooling was doing the harm, for when it was decided to keep on firing regardless of the flue, the accumulation dwindled away gradually to a point where it was easily controlled by a little work each day without cooling the furnace. Recently coal containing ash as high as 18% has been successfully used.

The side walls were found to have eaten away badly after only a few days of smelting, and various fettling materials were tried. Crushed magnesite bats, quartz and sand in turn were applied in the old way by throwing across the furnace, but none of them withstood the action of the basic slag and terrific heat (as high as 1650° C) for more than a few hours. Holes were made in the arch, along the side walls and bridge wall, through which sand and, later, siliceous ores were dropped. This method of fettling was an improvement, but was still regarded as "fettling" and not as "charging," as only sufficient material to cover the walls a few inches above the bath was used, and the charges were still dropped through the arch from six charge hoppers over the back of the furnace.

The arches, also, wore away rapidly, especially around the charge holes, and in October, 1913, the furnace was entirely rebuilt, in order to incorporate in it all the new features which experience had shown to be desirable. For 30 ft. from the burner end the arch was raised 2½ ft., sloping thence to the old level, which was reached 42 ft. from the burner end. Cast-iron skewbacks were used for the raised part of the arch and 12-in. box beams every 5 ft. formed buckstaves in place of single 12-in. I-beams at more frequent intervals. The magnesite bottom, having proved unsatisfactory—large patches had heaved up and floated out—was replaced by 24 to 30 in. of silica sand, tamped in place and sloped toward the tapholes in the approved style.

Finding the Proper Place for the Taphole

Tapping had always been difficult, and it became more so when it was found necessary to keep the walls covered with fettling. A taphole was opened about 6 ft. from the burner end and worked well until the wall became so thin at the slag line that it was necessary to fettle there, when it went the way of all previous tapholes. I might mention that the method of opening tapholes with oxygen, described on page 704 of the *Engineering and Mining Journal* of Oct. 20, 1917, was introduced at the Canadian Copper Co.'s works by the late D. H. Browne, who had seen it in use in Norway. Not until the taphole was placed immediately beside the skimming door did it work satisfactorily—since then a "freeze-up" has been a rare occurrence, even when starting the furnace after a shutdown of several days.

The new furnace bade fair to become a "world beater," although several patches of the sand bottom were floated soon after smelting was begun. The difficulty of providing a sufficient amount of siliceous ore for fettling soon arose. Flue dust was tried, but it smelted away too quickly and was therefore unsatisfactory.

From "fettling" a small amount to "charging" a large amount of ore along the walls was only a question of time—and competition between the two shifts for record runs—and in 1915 the charge holes in the arch were eliminated, as it developed that by piling the fettling up high on the side walls and thereby exposing

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more of it to the flame, more ore was smelted than by the fettle-and-charge practice, and also the arch lasted longer. Under present conditions there is only a narrow liquid bath in the center of the furnace, which widens out to the full width of the furnace at the skimming door and is deepest at that point, forming a sort of settler from which the matte is tapped as soon as it has settled. Continuous skimming has been tried and could be successfully practiced if furnace construction permitted.

The bridge wall has been opened around the burners from time to time, until at present the combined area of the openings is nearly equal to that of the throat of the furnace. Of course all side-door openings are covered with ore and have been bricked up long since. The fettling pipes which connect the hoppers with the holes in the arch are covered with small pieces of plate with handles attached. These plates are in turn covered with ore (they have superseded the old slide-gates, and are more satisfactory as well as less expensive), so there is no air taken into the furnace except that required for combustion. Radiation from the side walls is practically nil, on account of the large body of ore against them. In ordinary practice the throat temperature is maintained at 1000° to 1100° C, with a draft at that point of $\frac{3}{4}$ to 1 in. of water. The arch is made of silica brick and is 20 in. thick as far as the bottom of the "incline" and 15 in. thick from there to the end of the furnace. Side and bridge walls are also of silica brick—unnecessary in the former, as they have not been repaired for three years and are still as good as new. All openings in the bridge wall are lined with firebrick, to prevent cracking and spalling.

At present this furnace is smelting about 500 tons of charge and burning 96 tons of coal per 24 hours. The charge consists of 65% of hot calcines, 2% cold Wedge furnace flue dust, 15% cold blast-furnace flue dust and 18% green-ore fines carrying 2% to 5 or 6% moisture.

Fuel Economy in Brass Furnaces

The over-all heating efficiencies obtained in present brass-melting practice are compared by L. C. Harvey, (Institute of Metals, September, 1917, abst. *Journ. Soc. Chem. Ind.*) on the basis of the estimated output for 1916, namely, 2,000,000 tons of the 70:30 alloy melted and superheated to 10% above its melting point. The following ratios of total fuel consumed to that usefully employed are given, those for coke- and gas-fired furnaces being in terms of coal: Coke-fired pit and tilting furnaces, 27:1 and 9:1, respectively; tilting furnaces using powdered coal, 6:1; single crucible pit or tilting furnaces using town gas, 13:1; multiple-crucible pit furnaces or single-crucible tilting furnaces using producer-gas, 12:1; oil-fired pit and tilting furnaces, 19:1 and 7:1 respectively.

Notwithstanding the greater economy of the tilting furnace, pit furnaces employing smaller crucibles are still largely used on account of the better quality of metal produced. Suggestions are made for increasing the efficiency of coke- and oil-fired pit furnaces by improving the present designs, and drawings are given of a multiple-crucible furnace for oil, gas, or powdered coal, which has proved satisfactory, and of a special form of grate pan for economizing solid fuel in tilting furnaces.

Manganese Mining in Arkansas

By Tom Shiras*

The extraordinary demand for domestic manganese ore that has developed during the last two years has put new life into the Batesville field, in Independence and Izard counties, Ark. Spasmodic activity and almost negligible production marked the operation of Arkansas manganese mines from 1850 until the great war, but now about 2000 tons a month of hand-cobbed and fine-washed ore are being produced. Seven fairly large operations are in progress and many small operators are working either on their own lands or through leases and selling their ore to the larger interests.

The ores are in the form of various oxides in a residual clay derived from the decay of a bed of overlying limestone. Distribution of the ore in the clay is irregular. The pockets vary greatly in character. Sometimes they are comparatively solid bodies separat-

MANGANESE ORE READY FOR SHIPMENT AT PENTERS BLUFF, ARK., BATESVILLE DISTRICT

ed only by thin seams of clay, containing from 50 to 500 tons of ore, and, again, they consist of large and small masses of ore imbedded in greater or lesser quantities in certain places in the clay, and the ore has been found also in the form of small nodules or grains, disseminated throughout the clay. Most of these pockets of "wash dirt" contain from 5 to 25% of manganese ore. Some ore has also been found in its original form in broken limestone boulders that have not yet disintegrated.

Mining is carried on by openpits of all sizes, and by shafts and drifts. The deepest of these shafts is not more than 100 ft., and the underground work is not extensive, owing to the soft clay formation, which necessitates timbering. With the exception of one mine, the Polk-Southard, all the work is done by pick and shovel. At this property, however, one small steam shovel is in operation. By far the greatest part of the production of the field comes out of the ground ready for shipment, in chunks from the size of a man's fist to boulders that weigh several hundred pounds. The fine ore is recovered by screening and washing.

The seven larger operators in the field are Walter Dennison, R. S. Hanford, Independence Mining Co., Cleveland Mining Co., and Eureka Mining Co., all of Cushman, Ark., and N. A. Adler, and the Ozark Mining Co., of Batesville. Only four of these operators are

*Mountain Home, Ark.

using washing plants. The Eureka and Independence companies are using the regular log washers, which handle approximately 100 tons of dirt a day, and N. A. Adler and the Ozark company are using revolving screens, 10 x 2½ ft., which handle about 60 tons of dirt a day. Besides the operators named, there are many smaller ones, working on contracts for the larger interests; on leases, or on their own lands. The larger operators buy from the smaller in lots from a few pounds up, Walter Dennison acting as sales manager.

The ore is classified by the producers into two grades. The high-grade ore runs from 40 to 58%, and the low-grade scales down from 40 to 17%. Some has been shipped that assayed as low as 12%, but the production of this low-grade ore is not profitable. The bulk of the ore now moving is going to Birmingham, Alabama.

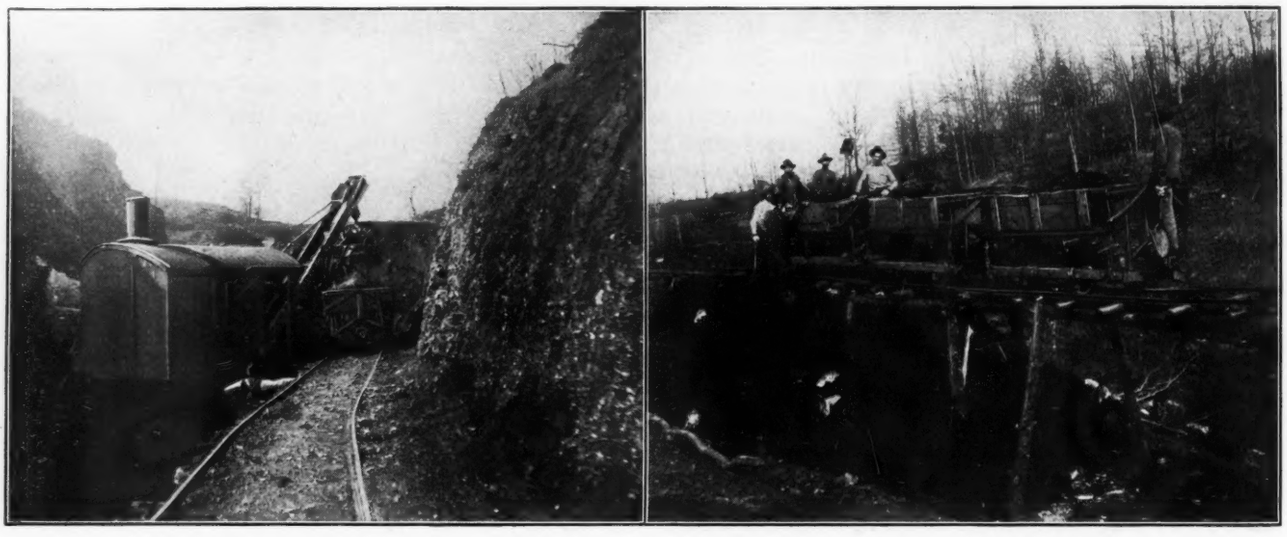
The proven area of the field is about 20 miles east and west and 15 miles north and south, in the northwest part of Independence County and the southeast part of Izard. Some outcrops have been found outside this area but they have developed no producing properties as yet. It is obvious that the field is capable of producing many times its present tonnage, the limit of production being governed by the number of men employed.

Owing to the fact that the ore lies in shallow beds, mining is carried on at a minimum expense, and but little initial capital is needed with which to start operations. Development is proceeding with many small units, and owing to the nature of the ore deposits will in all probability continue in this manner. At present more washing plants could be installed at a profit, as a great deal of the fine ore is thrown over the dumps.

John C. Branner, former state geologist, in his report of 1890 gives the following early history of the field: Col. Matthew Martin operated in the field from 1850 to 1852, making a few small shipments by boat, down the White River. The first shipment for the manufacture of steel was made by William Einstein, of St. Louis, and went to the Junita Iron Works, Pittsburgh, Penn., in 1868. From 1881 to 1887, the Ferro-Manganese Co. shipped 5000 tons. From 1885 to 1890, the Keystone Iron and Manganese Co. shipped 18,111 tons. During the same years the St. Louis Manganese Co. shipped 1700 tons, and the Missouri Furnace Co., 500 tons. With these and other sundry smaller shipments Mr. Branner puts the total production of the field from 1850 to 1890 at 35,000 tons.

Manganese in West-Central Arkansas

Besides the activity in the Batesville manganese district in northern Arkansas, the little-exploited deposits in the west-central part of the state are now receiving some attention. These deposits, which have lately been described[1] by H. D. Miser, of the U. S. Geological Survey, occur at intervals in a belt four to 12 miles wide. The belt extends west-southwest from Pulaski County, at the center of the state, to Polk County, on its western border. The recent exploitation is confined almost entirely to the mountainous districts in the northern parts of the Caddo Gap and De Queen quadrangles, in western Arkansas. The deposits have been worked only in a small way and have produced but a few hundred tons of marketed ore.



STEAM SHOVEL STRIPPING THE POLK-SOUTHARD MANGANESE MINE, NEAR CUSHMAN, ARK.

The manganese ores consist of the four oxides, psilomelane, pyrolusite, manganite, and wad, the first three forming the larger part of the ores. Although these minerals may be found separately, two or more are generally intimately mixed in the same deposit, and at some places they are associated with iron oxides and manganiferous iron ores. The manganese ores occur as nodules, pockets, and short irregular veins from a fraction of an inch to 4 ft. thick, though veins 4 ft. thick are rare. The orebodies are scattered through the hard Arkansas novaculite and can doubtless be found on every mountain where the novaculite is exposed. They occupy bedding planes or joint cracks or form a cement in a novaculite breccia in which the rock fragments range in diameter from a fraction of an inch to over a foot. Most of the ores contain too much phosphorus for use in the manufacture of ferromanganese and too much iron for use in chemical industries and electric batteries, and where the quality is suitable for these purposes the quantity is generally too small for profitable mining.

[1]Bull. 660-C, U. S. Geol. Surv., Washington, D. C

Activities of the U. S. Bureau of Mines for the Year Ended June 30, 1917

War conditions and the necessities arising therefrom created many new problems demanding consideration by the Bureau of Mines, but its routine work in diverse fields was in no measure neglected, as is disclosed by the appended record.

THE vital importance of the mining industry to the United States and its allies in the great war made the fiscal year ended June 30, 1917, a period of intensified activity for the U. S. Bureau of Mines. In addition to many technical investigations, much work was done on problems relative to national preparedness and defense. The Bureau's achievements in 1917 are summarized as follows in its annual report to the Secretary of the Interior:

More than 4800 miners in 23 states were trained in mine-rescue and first-aid methods. On June 30, 1917, a total of 46,873 miners had been trained by the Bureau since organization.

Representatives of the Bureau investigated 63 accidents or disasters throughout the United States, of which 57 were at mines. At the mines 103 men were rescued through the efforts of volunteer miners, company officials, state mine inspectors, and company rescue crews. At 19 of the 63 accidents investigated breathing apparatus was worn.

Many Miners Trained in Rescue Work

Twenty-two rescue and first-aid contests or field meets attended by Bureau members were held throughout the country. Some of these contests were arranged and supervised by Bureau men. More than 39,000 miners attended lectures on first-aid and rescue methods given at the Bureau's mine safety stations and cars.

Tests made during the year indicate that lime, which is considerably cheaper than caustic soda, can be used in the regenerators of oxygen breathing apparatus to replace caustic soda. Some further improvements were made in the Gibbs oxygen breathing apparatus, developed by the Bureau. First-aid methods and materials, as well as mine-rescue methods, were revised and standardized.

Investigations of the explosibility of coal dust under mine conditions have given valuable data for the determination of the relative hazard of dust explosions in coal mines throughout the country.

Tests of spreading rock dust in coal mines as a means of arresting or preventing coal-dust explosions have shown how the cost of protecting mines in this way can be decidedly reduced.

In coöperation with the Illinois Geological Survey and the department of mining engineering of the University of Illinois, the Bureau began a comprehensive investigation of the subsidence of the ground over coal mines.

The use of permissible explosives instead of black powder in the coal mines of Oklahoma, a change advocated by the Bureau, has continued to lessen the risk of explosions in those mines.

Studies of the explosives used for blasting in mines were continued with the aim of reducing the dangers that attend the use of explosives in mining.

Ten more explosives were tested and approved as permissible for use in dusty or gaseous coal mines. At the end of the year 151 explosives were on the permissible list.

Tests at the experimental mine of the Bureau have demonstrated that it is possible to determine whether black powder or a high explosive was used in a blown-out shot such as sometimes causes a disastrous mine explosion, and that it is easy to ascertain whether the high explosive detonated or merely burned.

Propylene-glycol was studied to determine the probable use of this substance in explosives, because of its cheapness and desirable properties, it is being substituted for glycerin in the manufacture of high explosives.

Investigations of mine fires at Butte, Mont., have shown the great loss caused by these fires, the difficulty of preventing them, and the need of further study.

Safety investigations made in coöperation with state officials have resulted in greatly reducing the danger from accidents in California mines.

Further progress was made in methods of eliminating from smelter smoke the fumes that cause injury to animals and crops and substantial advances were achieved in methods for utilizing the sulphur in the sulphur gases from smelteries.

Methods for treating the low-grade and complex ores of copper, lead and zinc have been further developed and are being tried on a commercial scale. These methods are expected to render available vast quantities of ore that now cannot be worked at a profit.

Extended Investigation of Flotation

Investigations of the flotation process for concentrating ores have shown how the use of this process may be extended and made more efficient.

A report on the methods of making salt in the United States was transmitted for publication.

Methods of mining and calcining gypsum and of preparing gypsum products were described in a report now in press.

An investigation of the methods used in quarrying cement rock is showing what are the most effective quarrying methods and types of equipment and the most effective ways of preventing accidents.

Clay-refining investigations have made vast quantities of domestic kaolin available for the use of American potters who formerly depended on foreign clays.

As a result of investigations that have been carried on in coöperation with the Bureau, one large copper company is expending $1,600,000 for equipment to recover dust and fume from the smoke of its smeltery.

Decided advances have been made in plans for utilizing locally the sulphuric acid that can be obtained from

smelter smoke; these plans include the manufacture of superphosphate for fertilizer and high-grade phosphoric acid, and the improvement of alkaline soils by direct application of acid.

A method of leaching oxidized ores of lead with an acid solution of common salt has been worked out that promises to be of wide value.

Further progress was made in applying a volatilization process (chloridizing roast) to the treatment of oxidized lead ores containing gold, silver, or copper.

Encouraging results have been obtained in the further development of a leaching process for low-grade zinc ores.

Reports discussing health conditions at iron and steel plants and the methods by which injuries and fatalities can be greatly lessened were revised and are now in press.

Further investigation of the viscosity of blast-furnace slags is yielding information that should be of great benefit to furnacemen and should facilitate the changes in practice necessary to smelt the lean and complex ores that will be used as high-grade ores become scarcer.

Material was collected for a comprehensive report on the hydrometallurgy of gold and silver and a popular report on the present condition of the cyanide process.

Experiments to Promote Economical Burning of Fuel in Power and Domestic Furnaces

Experiments with steam boilers have yielded reliable data for the design of boilers that will absorb a higher proportion of the heat from the furnace fires.

A study of the fuel-burning equipment and the conditions under which fuel is burned at more than 30 Indian schools and agencies throughout the country has shown how decided economies in the use of fuel at many of these institutions can be had.

The comparative values of different fuels, as coal and wood, for use in heating boilers for houses have been determined through an extensive series of experiments.

A bulletin showing the extent to which Illinois coals have been used in making coke and the possibility of extending such use was transmitted for publication.

An investigation aimed to increase the use of Illinois coal in the manufacture of illuminating gas was undertaken.

Investigations of methods of utilizing lignite have yielded additional facts of value to residents of the regions in which lignite abounds.

An improved electric furnace for melting brass has been devised and is being tested on a commercial scale; by its use it is hoped that the losses of metal in brass melting, which amount to millions of dollars annually, can be greatly reduced.

A comprehensive investigation of the fire clays of Maryland was undertaken.

Special consideration has been given the utilization of coal at Government plants throughout the country, and recommendations have been made looking to an annual saving of fully $300,000 in the Government's coal bill.

Studies of the combustion of coal in furnaces have brought out facts of great value to engineers in designing furnaces to burn different kinds of coal with greater efficiency and tests with boiler furnaces have shown how coal can be utilized more efficiently in heating dwellings.

Rules published by the Bureau for the purpose of setting a higher standard of safety in the electrical equipment of bituminous coal mines have been formally approved for trial by the American Institute of Electrical Engineers.

A flash lamp permissible for use in gaseous mines has been developed. Two new models of portable electric lamps were approved as permissible for use in coal mines. As a result of the investigations begun by the Bureau four years ago, more than 100,000 approved portable electric lamps are now in use in the mines of this country.

Further progress was made in the development of explosion-proof motors for use in gaseous mines.

An accurate, sensitive, and convenient electrical device for detecting gas (methane) has been developed. A satisfactory lamp for use in rescue and recovery work in mines after disasters has been completed.

Rare-Metal Investigation

Investigations of radium have resulted in improving the methods used in recovering radium from carnotite ores and pitchblende, and the treatment of carnotite concentrates has been facilitated. Through its radium investigations the Bureau has acquired more than a gram of radium element, valued at more than $100,000, which is to be used for scientific and medical research.

Investigations of methods of extracting molybdenum and vanadium, metals needed in the manufacture of special steels, are yielding important results.

From the uranium oxide obtained as a byproduct in the recovery of radium a high-grade ferrouranium has been prepared that promises to be of much value in the manufacture of uranium steel.

A pyrometer devised for measuring the melting point of brass and other nonferrous alloys should be of decided value to the brass industry.

The use of mud-laden fluid to save underground supplies of oil and gas and prevent wastes in well drilling has been greatly extended. Through coöperative work in various states improved drilling methods are being more widely used.

An investigation of methods for increasing the recovery of oil from oil sands has shown the enormous quantities of oil left underground in many oil fields and has suggested methods of preventing such waste in future.

A bulletin on "Cost Accounting for Oil Producers," believed to be the simplest and most comprehensive treatise on this subject, has been prepared for publication.

Cementing methods of excluding water from the productive sands penetrated by oil or gas wells, thus preventing great loss of oil and gas, the decline of oil wells and the ultimate production of oil lands, were investigated.

Methods of storing petroleum in tanks or reservoirs were described in detail in a report submitted for publication and methods by which the proportion of gasoline obtainable from natural gas is being greatly increased were described in a bulletin on the absorption process for recovering gasoline.

Compression plants for recovering gasoline from natural gas and many details of plant practice were described in a bulletin submitted for publication. Ex-

perimentation with what are known as topping plants for separating the higher hydrocarbons from crude oil has shown how much waste of gasoline at such plants may be prevented.

An investigation of the fires that annually cause great losses in the oil fields of this country disclosed the need of using preventive measures in advance of present practice.

A comprehensive report on the Diesel engine has been prepared for publication as a bulletin.

An investigation of the use of gas traps at oil wells has shown what are the best types of traps and that great quantities of gasoline have been wasted at oil wells through failure to use these devices.

Commercial types of gasoline sold throughout the United States were examined and methods for making satisfactory laboratory tests were published.

The characteristics of different types of gasoline and their relative merits as motor fuel were determined.

Further work was done in the commercial development of the vapor-phase process for obtaining gasoline from heavier petroleum products.

Investigations of the oil shales in Colorado and Utah demonstrated that it is now feasible to work these shales as a source of petroleum in competition with oil from oil wells.

Methods for determining the fusibility of coal ash and the consequent liability of coal to clinker were improved.

Further progress was made in the investigations of mine gases.

American Trona Corporation

At the meeting in London of the Consolidated Gold Fields of South Africa, the predominating interest in the American Trona Corporation, Lord Harris, the chairman, spoke on Nov. 15 of the prospects of potash production from its Searles Lake plant at Trona, Calif., as follows:

"Now, as regards American Trona Corporation, you will, I am sure, be anxious to hear the latest news of that venture. It has taken a longer time than we originally anticipated to reach the producing stage. We were unlucky in our first production plant, which failed to come up to expectations. I am happy to say that the second effort has been successful—I think I may say very successful. The producing stage was reached at the end of October last year, since when the plant at Searles Lake has been in continuous operation. Owing to the fact that the mixed salts produced are required in ever-increasing quantities for fertilizing purposes, and command a satisfactory price, it was decided not to press on with the completion of the refinery at San Pedro, which, consequently, will not be in operation till early in the coming year, by which time the second unit of plant at Searles Lake should be completed. All chemical difficulties have been overcome and the Grimwood process has proved its ability to solve the problem of separating all the constituent salts of the brine.

"Up to now, however, we have suffered considerable disappointment as regards the output of mixed salts, on which at present the Trona Corporation depends for the greater part of its income. For the seven months ended Aug. 31, the output of these salts has amounted to 8348 tons, or an average of a little over 34 tons per day, as against the 70 tons which we were informed might be anticipated. This reduced output is in some measure due to the abnormal heat prevailing in the desert from May to September inclusive, which retards the crystallization of the salts. With the return of cooler weather, we may expect a considerably increased production, and, after certain supplementary plant now on order has been installed, the daily output of the first unit will, it is estimated, amount to at least 70 tons. The most recent telegram as regards production shows that in October we had got up to 43½ tons, and had also sold 55 tons of high-grade potash for the chemical trade. You will be interested to know that the profits for the month of October amounted to $133,000; that was on an output of about a quarter of what we anticipate it will be when the second unit at Searles Lake and the refinery at San Pedro are complete, which we hope will be the case next April.

"The difficulty of obtaining and forwarding structural steel has greatly delayed the erection of the second unit, and has involved a serious increase of capital expenditure, which, however, is compensated for by the abnormal price of potash now ruling and likely to rule for some time to come. The approaching completion of the second unit and of the refinery will result not only in a largely increased production of the mixed salts required for fertilizing purposes, but will also enable the corporation to produce a considerable amount of practically pure potash required by the chemical trade, as well as to segregate and market the borax, which is the most important of the corporation's byproducts.

"The title question is still undecided. The hearing of the corporation's application for patent took place at Washington at the end of September, and we are informed that our representatives await the decision of the commissioners with complete confidence. The corporation has done good work in helping to allay the potash famine in the United States which the war has caused, and we feel justified in believing that the Government of that allied country will not fail to show some recognition of this fact in its treatment of the corporation. Of course, we have to anticipate a falling off in the price of potash after the war, when its exportation from other parts of the world recommences, but that will be compensated for by the production of byproducts, which we believe has been satisfactorily proved at the San Pedro refinery."

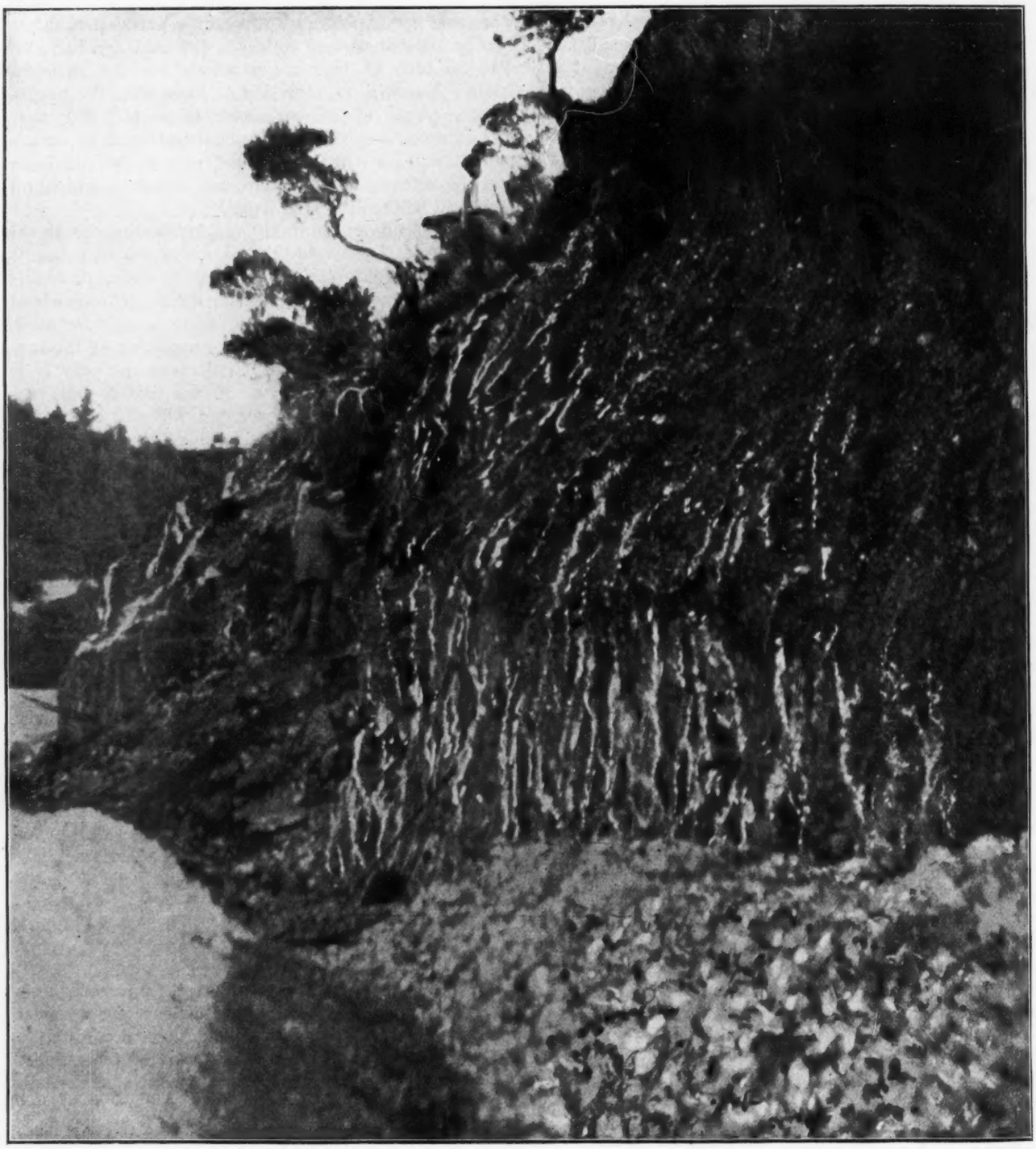
Liability of Mine Managers

By A. L. H. Street*

Persons managing a mining company's property may be held personally liable if they deliberately trespass upon the land of another, to his injury, according to the decision rendered by the Missouri Supreme Court in the recent case of Robinson vs. Moark-Nemo Consolidated Mining Co. et al., 196 Southwestern Reporter, 1131. In this case the plaintiff complained that his land, which adjoined that used by the company in the operations of mining and cleaning zinc ore, had been used, in spite of his protests, for depositing refuse and tailings from the mine, whereby it became covered to a depth of 100 feet.

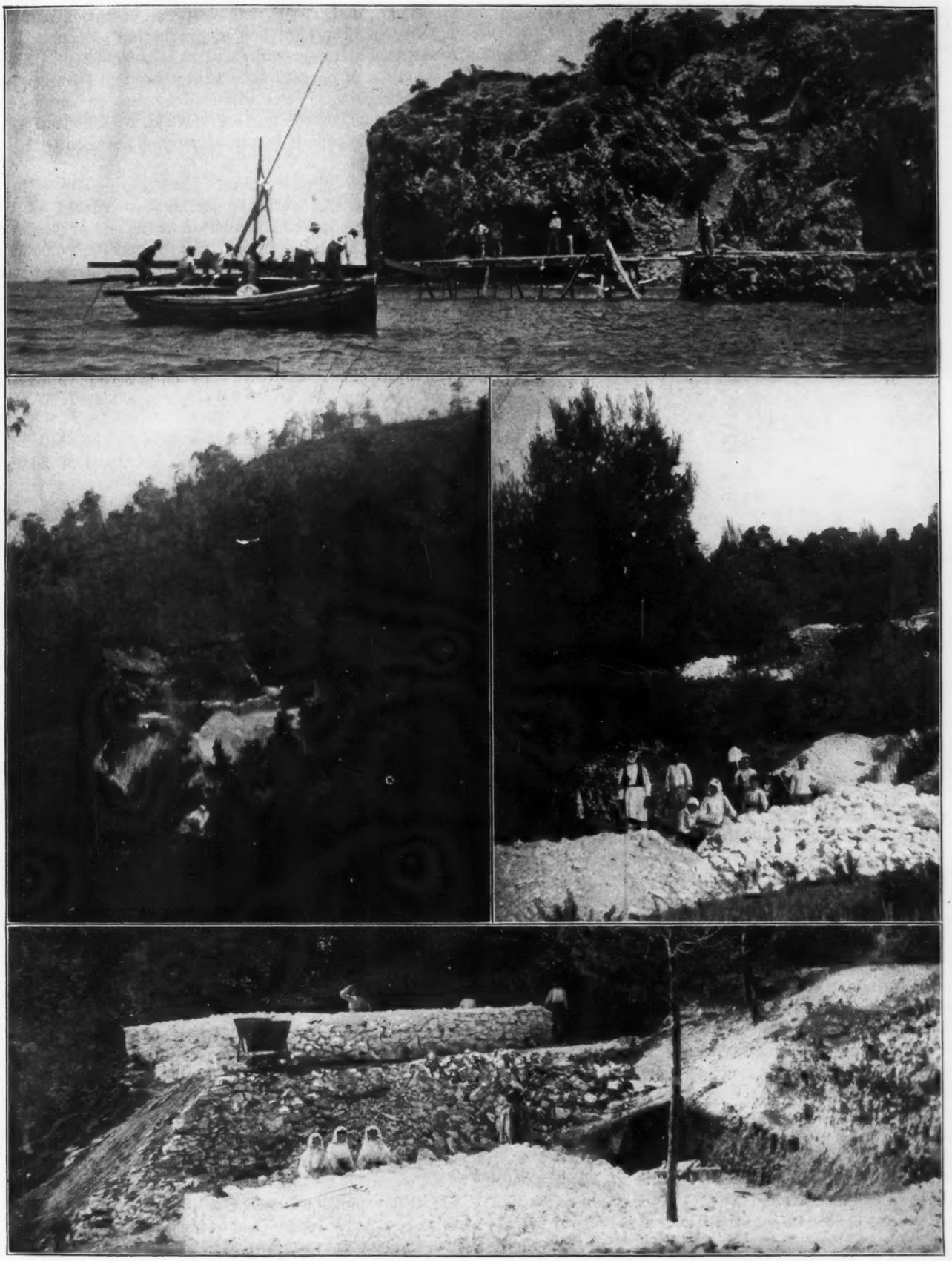
*Attorney at law, 829 Security Bldg., Minneapolis, Minn.

Magnesite Mining on Euboa Island, Greece



OPENCUT IN NORTHEASTERN PART OF EUBOA ISLAND, SHOWING MAGNESITE OUTCROPPING AS VEINLETS IN SERPENTINE

This property, consisting of three claims, is operated by the General Magnesite and Magnesia Co., of Philadelphia, and produces a sorted ore that has averaged as high as 96.5% magnesium carbonate. The deposits are of fine-grained massive type, occurring as veins and are associated with altered basic intrusive magnesian rock



EUBOA ISLAND, GREECE, WHERE MAGNESITE DEPOSITS OF UNUSUAL PURITY OCCUR

Materials are unloaded from steamships into small boats and are taken directly to the opencuts of the magnesite mines that outcrop on the coast of Xycupotamo Bay. Euboa Island is well covered with forest and undergrowth. Peasant girls of the Aghia-Anna village, Euboa, sort the magnesite from the serpentinous rock in which it occurs, arranging it in stockpiles on the mine dump

California Mineral Production in 1916

The mineral output in California during 1916, according to Bull. 74, issued by the California State Mining Bureau, was valued at $127,901,610. Of the 58 counties in the state all but one contributed some mineral product. The net increase in the grand total value over 1915 is $31,238,241 and it is the first time in the history of California that the total mineral yield for a year had passed the $100,000,000 mark. The production of the different minerals and metals is shown in the table.

CALIFORNIA MINERAL PRODUCTION IN 1916

Antimony ore, tons	1,015	Magnesium chloride, tons	851
Asbestos, tons	145	Manganese ore, tons	13,404
Barytes, tons	1,606	Marble, cu.ft	25,954
Bituminous rock, tons	19,449	Mineral paint, tons	643
Borax, tons	103,523	Mineral water, gal	2,273,817
Brick and tile, M	206,960	Molybdenum ore, tons	8
Cement, bbl	5,299,507	Natural gas, M. cu.ft	28,134,365
Chromite, tons	48,943	Petroleum, bbl	90,262,557
Clay, tons	134,636	Platinum, oz	886
Coal, tons	4,037	Potash, tons	17,908
Copper, lb	55,809,019	Pumice and volcanic ash, tons	1,246
Dolomite, tons	13,313	Pyrite, tons	120,525
Feldspar, tons	2,630	Quicksilver, flasks	21,427
Fullers earth, tons	110	Salt, tons	186,148
Gems	$4,752	Sandstone, cu.ft	17,270
Gold	$21,410,741	Silica (sand and quartz), tons	20,880
Granite	$535,339	Silver	$1,687,345
Graphite, lb	29,190	Soapstone and talc, tons	1,703
Gypsum, tons	33,384	Soda, tons	10,593
Infusorial earth, tons	15,322	Stone, miscellaneous *	$4,171,519
Iron ore, tons	3,000	Strontium, tons	57
Lead, tons	6,196	Tungsten concentrates, tons	2,270
Lime, lb	493,635	Zinc, lb	15,950,565
Limestone, tons	187,521		
Lithia, tons	71		
Magnesite, tons	154,052		

* Includes macadam, ballast, rubble, riprap, paving blocks, sand, gravel, and grinding mill pebbles.

California is the most important producer of borax and until recently, was the sole domestic source of chromite and magnesite. About 75% of the quicksilver of the United States is produced in California. Motor trucks have been instrumental in opening mineral properties at formerly unprofitable distances from railroads and this has induced the building of better roads everywhere, to the benefit of the miner and farmer.

Strike Results in Arizona

The report of the secretary of the Arizona Chapter of the American Mining Congress, presented at the annual meeting of the congress at Phoenix, Ariz., Dec. 3, 1917, submitted the following statement as to the effects of strikes on copper production, and it was ordered that these matters be brought to the attention of the National Industrial Conference Board:

Strikes in Arizona this year were confined to the mining industry, with the exception of a few days' trouble on the Arizona Eastern R.R. and some minor differences in the cotton fields and among building contractors. Metal producers' total loss of copper output to Jan. 1 will probably reach 120,000,000 lb. Unless there are new disturbances, not now in prospect, January will witness a return to nearly normal output. Reorganization of forces and reëstablishment of operating efficiency of plants prevent earlier regaining of normal output.

Strikes became effective in Jerome in May, participated in by I. W. W. and Western Federation and lasted two weeks before being settled through Federal mediator. Reoccurrence under a call of the I. W. W. partly closed mines for several days in June. The trouble was terminated by deportation of the I. W. W. leaders. Due to access of mines to exceptionally rich ores and some stocks ahead at smelteries, output of metal made stronger recovery in October.

The Globe and Miami mines were closed entirely by strike calls of I. W. W. and Western Federation on July 1. Two months total loss of production of copper has been conservatively estimated at 40,000,000 lb. Slow resumption of operations in September and stronger recovery in October was attended by loss in these two months of 25,000,000 lb. from normal, with at least 10,000,000 more pounds loss to be counted between October and January.

Clifton and Morenci mines closed down entirely July 1, remaining idle until the strike was ordered off by President's mediation commission at the end of October. Loss of copper output in four months was 32,000,000 lb. At least 8,000,000 lb. more will be lost between now and possible attainment of normal by January.

Bisbee district strike entailed probably not more than 5,000,000 lb. loss from normal copper output, due to large advance stocks of ore bedded at smelteries by all companies except Shattuck-Arizona. Strike called by I. W. W. June 27, ended by deportation of I. W. W. members July 12.

Loss in wages attendant on strikes in the state has been estimated at over $5,000,000. A total of 25,000 men were affected by the strikes.

Fatalities in Mineral Industry in 1916

A summarized statement of fatalities in the mineral industry of the United States for the year 1916 shows a gratifying decrease, according to statistics compiled by Albert H. Fay, of the U. S. Bureau of Mines, in the fatalities that occurred in coal mines, metal mines, metallurgical works and byproduct coke ovens. The number of men employed in 1916 was 1,128,257, as compared with 1,067,929 in 1915, and the total number of fatalities in 1916 was 3224, as compared with 3076 in the previous year. The principal increase in the number of men employed occurred in metal mines and metallurgical works, while there was a slight decrease in the coal mines and quarries. Fatality rate per 1000 men employed for the industry as a whole was 2.86, as compared with 2.88 in 1915, while the same figure, equated to a 300-day basis, was 3.37, comparing with 3.74 for 1915. The principal decreases, based on the 300-day basis, are as follows: Coal mines in 1916, 3.93 per thousand 300-day workers, as compared with 4.44 in 1915; metal mines, 3.62, as compared with 3.89; ore-dressing plants, 1.41, as compared with 1.57; smelteries, excluding iron-blast furnaces, 0.73, as compared with 1.05; byproduct coke ovens, 1.35, as compared with 1.75. Quarries and beehive coke ovens show slight increases.

FATALITIES IN U. S. MINES AND WORKS IN 1916

	Number of Men Employed	Equivalent Number 300-Day Workers	Number Killed	Fatality Rate Per 1,000 Employed	Per 1,000 300-Day Workers
Coal mines	720,971	565,766	2,226	3.09	3.93
Metal mines	204,685	192,455	697	3.41	3.62
Quarries (inside)	60,944	49,077	114	1.87	2.32
Quarries (outside) *a*	29,853	27,380	59	1.98	2.15
Metallurgical works:					
Ore-dressing plants	22,365	23,470	33	1.48	1.41
Smelteries	43,829	49,363	36	0.82	0.73
Auxiliary works *b*	14,007	15,763	14	1.00	0.89
Coke ovens:					
Beehive	18,570	18,591	24	1.29	1.29
Byproduct	13,033	15,528	21	1.61	1.35
Total 1916	1,128,257	957,393	3,224	2.86	3.37
Total 1915	1,067,929	822,827	3,076	2.88	3.74

a Includes rock crushers, rock-dressing plants, etc.
b Includes shops, yards, construction, etc.

Correspondence and Discussion

Formation of Quicklime in Roasting

I have read with interest the article by W. S. Palmer, in the *Journal* of Sept. 22, entitled the "Formation of Quicklime in Roasting Ores from Manhattan, Nev.," and the discussion of it by M. W. von Bernewitz in the *Journal* of Nov. 17. Mr. Palmer states that most of the trouble encountered in subsequent cyanidation was due to excess lime. While I realize that excess lime causes a great amount of "grief," from a mechanical source, I wonder whether some of the trouble was not due to the formation of calcium sulphate, as stated by Mr. von Bernewitz. In the autumn of 1913, while developing a process to extract the silver and gold from ores of the Ophir mine, at Butte, Mont., I made the following tests: The sample assayed 11.96 oz. of silver and $0.80 in gold per ton. It was ground to pass through a 200-mesh screen. In test *A* some of the ore was washed with a sulphuric-acid solution containing 5 lb. of sulphuric acid per ton of solution. After filtering off the acid wash a milk of lime was poured over the ore to neutralize the acid and to act as a lime charge for subsequent cyanidation. The lime was added without using a water wash after the sulphuric-acid treatment. Some of this treated ore was then placed in a bottle with twice the amount of a cyanide solution having a strength of 10 lb. of cyanide per ton. It was figured that there was in this charge the equivalent of 10 lb. of lime per ton of ore. One pound of litharge per ton of ore was added. The mass was shaken in the bottle intermittently and the test allowed to run for 30 hours.

Another portion of the original ore was placed in a bottle with the same amount of chemicals as used in test *A*. In the latter test, or test *B*, the acid treatment and lime wash were omitted. This was allowed to run 30 hours. The percentages of extraction of the gold and silver in test *A* were 13% and 14.7% respectively, and in test *B* the corresponding figures were 95% and 56.5%. The cyanide consumption per ton of ore in *A* was 0.6 lb. and in *B* 4.2 lbs. I concluded that the difference in results was due to the formation of calcium sulphate in test *A*, which either made a film around the metal particles or caused a state of electrolytic equilibrium so that the cyanide could not act, as the consumption of the latter was so slight.

I next took a sample of the same ore, gave it an acid treatment and then washed out all traces of the acid with water before adding the lime solution. Upon subsequent cyanidation of this sample, I obtained results a little better than those in test *B* with a slightly smaller cyanide consumption. All of my tests were run in cold solution.

Mr. von Bernewitz states that the gypsum troubles at Kalgoorlie were remedied by adding solution to the hot ore as it came from the roaster. This is practically equivalent to adding very hot solution. If the calcium sulphate merely formed a coat over the metallic particles, it is possible that the hot solution permeated this coat as it does in some of the silver ores of Mexico and Tonopah. If the calcium sulphate acted chemically, it is possible that some of it was dissolved in ammonium-sulphate solution, as I believe that cyanide solution poured over hot ore will readily give up some ammonium radicals, which for the moment may combine with sulphate in the ore and the $CaSO_4$ giving the salt $[Ca(SO_4)_2]$ $(NH_4)_2$. This case is rather far fetched but it is a possibility.

From what has been written it would seem that where roasting is required, it should be done at a fairly low temperature, followed by adding the equivalent of very hot solution to cyanide ores containing calcite and sulphides. However, the addition of ammonium or ammonium salts, when the solution meets the ore, might give surprising results. CARL J. TRAUERMAN.

Butte, Mont., Nov. 20, 1917.

Hookworm in California Mines

On page 848 of the *Journal* of Nov. 10, 1917, under the general heading "Industrial News from Washington," there appears a short article on "Hookworm in California Mines," in which the following statement is made: "Inasmuch as 50 to 80% of the men working in the mines are infected, drastic recommendations for eradicating the disease have been drawn up."

It is evident that this reference to hookworm in California mines was prompted by the recent issuance of Bull. 139 of the Bureau of Mines, entitled, "Control of Hookworm Infection at the Deep Gold Mines of the Mother Lode, California," by Dr. J. G. Cumming and Joseph H. White. This bulletin treats of the work done by Dr. Cumming and Mr. White during the spring and early fall of 1916, although this fact is not set forth in the text. At the top of page 6, under the conclusions of Dr. Herbert Gunn, it is stated that "from 50 to 80% of those working in these mines are infected." On the preceding page, however, it is shown that these conclusions were reached by Dr. Gunn as a result of an investigation conducted in 1909.

During the last year or two articles have appeared from time to time in various technical and other publications relating to hookworm on the Mother Lode. In some of these it was indicated that conditions were extremely serious; none has referred to recent progress in combating the disease. While it is true that conditions have been rather grave and that much remains to be done in order to eliminate the cause of infection, it is believed that opinion somewhat unjust and harmful to the mines of the Mother Lode has been created. In view of the fact that miners recently coming from other metal-mining districts were found to have hookworm, it is not improbable that investigation will establish the fact that there are other sources of infection, especially the hot mines of districts in states other than California. There is evidence in hand which makes

it fairly certain that infection comes continually into the mining districts of California and other states with miners from the south of Europe, especially from the Balkan States. A large element of the labor in the Mother Lode at present is derived from these sources.

Advances in Sanitary Conditions and Treatment of Infected Cases Have Improved Situation

On page 9 of Bull. 139, above referred to, it is shown that, out of a total of 1096 men examined in eight mines, 337, or approximately 31%, were found to have hookworm infection. The lowest ratio of infection was 16% in one mine, the highest being 54%. On page 8, referring to conditions in 1916, the following statement appears: "The conditions of the Mother Lode mines and how they compare with conditions in other mining districts of the United States are discussed in some detail on pages 9 to 35, but in general it may be said that the sanitary conditions are believed to be above the average." Since this investigation was made and Bull. 139 published, many miners who had hookworm infection have been given treatment and pronounced cured. Advance has also been made in sanitary conditions at some of the mines referred to, particularly in connection with the use of sanitary latrines.

Dr. R. W. Nauss, state sanitary officer, central district, California State Board of Health, who spent the winter of 1916-17 on the Mother Lode diagnosing and treating cases of hookworm, brought out many interesting and valuable facts. Without submitting actual percentages, Dr. Nauss makes the following statement bearing upon the prevalence of the disease: "My resurvey for diagnosis indicates a very appreciable reduction in percentages as compared to those given by Messrs. Cumming and White in their report. Upon leaving the Mother Lode in April the percentages of infections at mines where treatment was carried out showed marked reduction. Those who have taken treatment faithfully and persistently testify to their improved condition. Officials also on numerous occasions have noted the benefit derived in the way of increased efficiency among their men."

Examinations by the Culture Method Are 50% More Effective Than Microscopic Examinations

Within the last three months the control of hookworm infection in the district has been placed in the hands of Dr. C. A. Kofoid, consulting biologist of the state board of health. Sufficient funds have been appropriated, and the state board of health has determined to continue its work until the infection is entirely under control. Through the courtesy of Dr. Kofoid I am able to submit some facts bearing on the present situation. The recent work in the examination of miners has not progressed far enough to submit extensive figures. During September and October, 1917, 304 men were examined in six mines, and 97, or approximately 32%, were found to have hookworm infection. The lowest ratio was 11% in one mine and the highest 60%. Four out of the six mines showed a ratio of infection of 24% or less. The examinations for hookworm are now being made by the culture method. Stools of miners are cultured in incubators, and if any infection whatever is present it can be detected within 10 days. This method is approximately 50% more effective than the customary microscopic examination heretofore employed in hookworm work in California, which is an important consideration in comparing recent infection percentages with results obtained previously.

The statement that the mines of the Mother Lode show an infection of hookworm of from 50 to 80% may have been correct for certain mines in the past, but it is certain that it is not now and probably never has been true of the mines as a whole in the Mother Lode, for the reason that in certain mines sanitary measures have been rigidly enforced for years. Other mines are comparatively dry. Hookworm spreads and miners become infected in warm, moist mines in which sanitary measures are not enforced. The dry climate of the mining district, the fact that many of its mines are relatively dry, and that improved methods of ventilation which reduce heat are being introduced all favor the suppression of the disease and will facilitate the speedy control and reduction of hookworm infection to a minimum.

Edwin Higgins,
Safety and efficiency engineer,
California Metal Producers' Association.
San Francisco, Calif., Dec. 3, 1917.

Oregon Nitrate Promotions

With reference to Northwestern nitrate promotions, now being advertised in some Oregon papers, I believe that money so invested will be practically a total loss. As I understand that some Western men are trying to interest capital for the development of such deposits, the experience of the American Nitrate Co. should be given publicity.

The American Nitrate Co., in which I was interested, spent about $140,000 in prospecting four or five nitrate deposits in southeastern Oregon that had been selected as the most promising among many similar discoveries. The exploration work was in charge of Harry Wilson, who was assisted by various chemists. In canyons deposits were found assaying all the way from 2% up to 10% in potassium and sodium nitrates. These were usually in crevices, although not always, and in some cases the nitrates were in the rock itself, the latter being of a somewhat porous character. Under the microscope it was found that the nitrates were deposited by ascending solution, which gave color to the supposition that there existed possibly a large underground supply. A good many tunnels were driven into the canyon walls for from 5 to 30 ft.; in other places drilling was done, as occasionally clay beds would be found carrying from 1% to even as high as 4% of nitrate. In the case of the clays, the richest findings were on the surface and for but a few inches down. With depth the percentages became almost negligible. In the canyon walls the rich deposits seldom extended more than two to five feet.

As to the origin of the deposits I shall not speak further, but the exploration work of the American Nitrate Co. covering a two-year period on five properties which were selected as the best to be found in southeastern Oregon convinces me and my associates that the nitrates do not exist in commercial quantities.

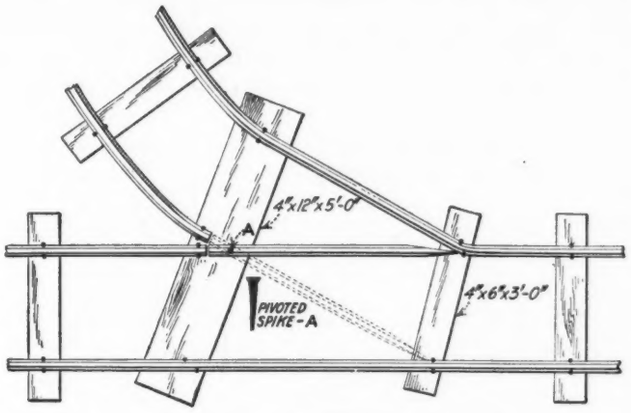
C. R. Cole,
President, Industrial Securities Co.
Chicago, Ill., Nov. 30, 1917.

Details of Practical Mining

Frogless One-Point Switch

BY H. M. WIRTZ*

A frogless switch, adaptable for mine use and one that may be installed quickly and cheaply, is shown in the accompanying sketch. It consists of a single-rail drawn to a point at one end with the opposite end

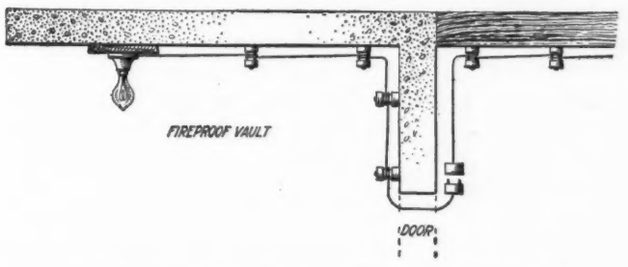


A ONE-POINT SWITCH FOR MINES

drilled so that a small spike may be driven through, fastening the rail to the tie and serving as a pivot on which it acts. The rail may then be moved in either direction laterally and performs the same duty as a frog switch. A number of these switch points are kept on hand so that they may be installed on short notice.

Electric Light for Vault

The accompanying sketch shows a system of wiring by means of which it is possible to have electric light in a vault where valuable maps and records are stored and at the same time comply with the insurance laws re-



A CONVENIENT VAULT LIGHT THAT AVOIDS SHORT-CIRCUITING

garding permanent lights in vaults. The connection is broken at the Hubbell plug switch when the occupant leaves the vault, allowing no opportunity for short-circuiting or grounding. All the wiring is according to standard practice.

*Bisbee, Ariz.

Hoisting Plant at United Eastern Mine

The headframe of the United Eastern Mining Co., at Oatman, Ariz., is 32 x 36 ft. 6 in. at the base and 76 ft. from collar to sheave center and stands over a three-compartment shaft, each compartment being 5 x 5 ft. in the clear. The hoisting sheaves are 7 ft. in diameter, with $4\frac{7}{16}$-in. bore, and carry a 1-in. rope. The manway sheave is 2 ft. 6 in. in diameter, with $2\frac{15}{16}$-in. bore, carrying a $\frac{1}{2}$-in. rope. Construction cost of this headframe is given in the accompanying table.

COST OF UNITED EASTERN HEADFRAME

	Labor	Material	Miscellaneous	Total
Excavation	$387.84	$33.25	.....	$421.09
Concrete	72.12	42.17	.....	114.29
Machinery, f.o.b. Oatman	.....	331.07	.....	331.07
Machinery, erection	8.38	.....	.....	8.38
Building lumber	.....	1,760.09	.....	1,760.09
Lumber framing and erection	1,107.41	248.32	$33.75	1,389.48
Electric wiring, f.o.b. Oatman	.....	65.10	.....	65.10
Electric wiring, erection	51.60	.....	.....	51.60
Engineering, field	25.00	.....	.....	25.00
Painting	35.00	.....	.....	35.00
Total	$1,687.35	$2,480.00	$33.75	$4,201.10

On the opposite side of the shaft from the headframe, the mine-run bin is built up above a fill through which concrete walls, 12 in. thick, are placed on 7-ft. centers at right angles to the contours of the hill. The bin is designed to discharge 100 tons by gravity through a gate near one side in the bottom on a steel apron feeder. The ore is hoisted in two 2-ton, specially designed Kimberly-type, self-dumping skips working in balance. The skips are loaded from pockets, at the various levels, having chutes swinging on vertical axes. Each skip is built integral with a cage above it which is used to hoist waste to the shaft collar in cars, as well as for men and mine supplies. One skip and cage together weigh 4860 lb. The total starting load on the hoist under maximum conditions, that is, operating out of balance and having 2 tons of ore in the skip, 1 ton of waste in the cage and $\frac{3}{4}$ ton of cable, totals about $4\frac{1}{4}$ tons; and under ordinary conditions of operating in balance the starting load is about $2\frac{3}{4}$ tons.

The hoist- and compressor-house equipment includes an Allis-Chalmers double-drum electric hoist, with parallel-motion post brakes, connected through herringbone gears with a 150-hp. motor, rope speed being 800 ft. per min. The hoist is equipped with an automatic accelerator, an electric overwinding device operating a solenoid brake on the motor shaft and further protected by a push-button cutout at the operator's hand. The drums are mounted with clutches so that either drum may be run independently. A 19 x 12 x 16-in. belt-driven Ingersoll-Rand compressor furnishes 888 cu.ft. of free air at 100-lb. pressure. This is driven by a 150-hp. Allis-Chalmer motor, operating at 695 r.p.m. and having a 24 x 20-in. pulley.

*Excerpt from a paper by Otto Wartenweiler entitled "United Eastern Mining and Milling Plant," to be presented at the New York meeting of the American Institute of Mining Engineers in February, 1918.

The primary-crushing department, situated beside the headframe, consists of a No. 6 Telsmith crusher belted to a 50-hp. motor and is automatically fed by a 42-in. steel apron feeder moving 1½ ft. per min. and delivering 25 tons per hour on an 18-in. wide 20° inclined belt conveyor passing over a Merrick weightometer, the conveyor discharging into a 24 x 24-ft. circular wooden tank bin. The cost of this department was: Labor $2456.50; material $9504.81; miscellaneous $14.06; total $11,975.37. The sum of $1916.27 was spent on the coarse ore bins, including $953.97 for labor and $962.30 for material.

CONSTRUCTION COSTS OF COMPRESSOR-AND-HOIST HOUSE

	Labor	Material	Total
Excavation	$965.21	$785.95	$1,751.16
Concrete	16.25	60.22	76.47
Hoist:			
Machinery, f.o.b. Oatman	.....	8,434.02	8,434.02
Machinery, erection	245.00	96.48	341.48
Compressor:			
Machinery, f.o.b. Oatman	.....	3,991.21	3,991.21
Machinery, erection	283.07	67.14	350.21
Building lumber	.....	572.17	572.17
Lumber framing and erection	568.51	80.21	648.72
Building covering in place	47.50	324.02	371.52
Doors and windows in place	6.50	2.57	9.07
Piping, f.o.b. Oatman	.....	108.79	108.79
Electric wiring, f.o.b. Oatman	.....	1,505.60	1,505.60
Electric wiring, erection	295.93	.....	295.93
Engineering, field	181.65	.....	181.65
Painting	1.88	22.72	24.60
Installing equipment	1,292.74	3,679.32	4,972.06
Total compressor-and-hoist house	$3,904.24	$19,730.42	$23,634.66

Storing Scrap Material

War-time prices on all raw material consumed or required in mining and manufacturing industries are high, and furthermore, the supply of many materials, especially in finished products, such as machinery, is difficult to obtain on short delivery. The third factor, and the one of greatest importance in the present crisis, is the necessity for conserving all materials whether it be commercially profitable or otherwise—this in the interest of the present endeavor to concentrate all our resources on winning the war. The time-honored scrap heap, with its miscellaneous assortment of discarded tools, appliances, machine parts and waste products of manufacture, cannot be of profit to any but the dealer in junk—a speculator or broker with whom we may profitably dispense. If all material when discarded could be at this time classified and segregated, and either baled or stored in special bins, an accumulation of junk could be evaluated to a degree of accuracy impossible under former conditions, and that which could not be utilized at the plant could be disposed of on more equitable terms as a result of more accurate appraisement. Such practice would not require the services of an additional attendant. Those employees who have occasion to add to the scrap heap may be instructed as to where each class of scrap should be relegated. The men would get the habit, and as the common cause has brought the appeal for conservation to all classes, the point would become a personal matter and coöperation should not be difficult to obtain.

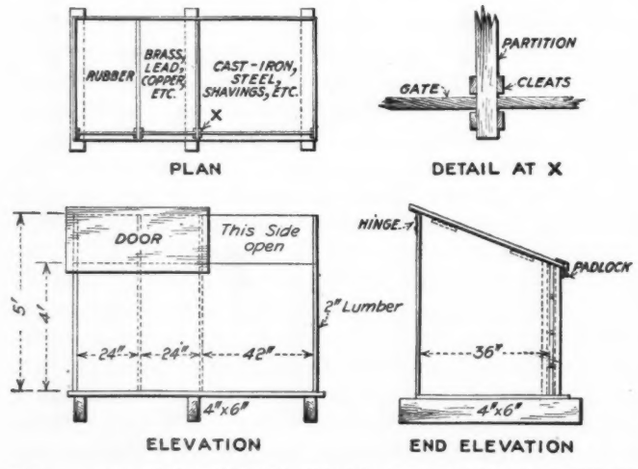


FIG. 1. BIN FOR STORING SMALL BUT VALUABLE SCRAP

In the illustration, Fig. 1 shows a three-compartment box suitable for the storage of brass, copper, rubber, babbitt, or other small pieces that ordinarily accumulate about a shop. The box is cheaply constructed, and a sufficient number of such containers should be distributed throughout the plant at convenient points, and labeled "Scrap Material" or "Waste." The two compartments for rubber scrap and higher-priced metals have a hinged cover provided with a lock, the key to which should be retained by the foreman of each department. For the heavier scrap material, no housing is necessary. Fig. 2 shows how a plot of ground may be staked off so that segregation can be made with convenience and an inventory taken when desired. This storage yard preferably should be near the railroad station at the plant. Each section is separated on four sides from the adjacent sections by avenues, and a double-faced sign, designating the character of material, should be placed in the center of each group. This sign is mounted on a pole of a height sufficient to prevent concealment after a large amount of scrap has accumulated. When individual piles of scrap have accumulated to the full capacity of the storage space, a shipment can be made, and disposal by sale can be given a fair valuation.

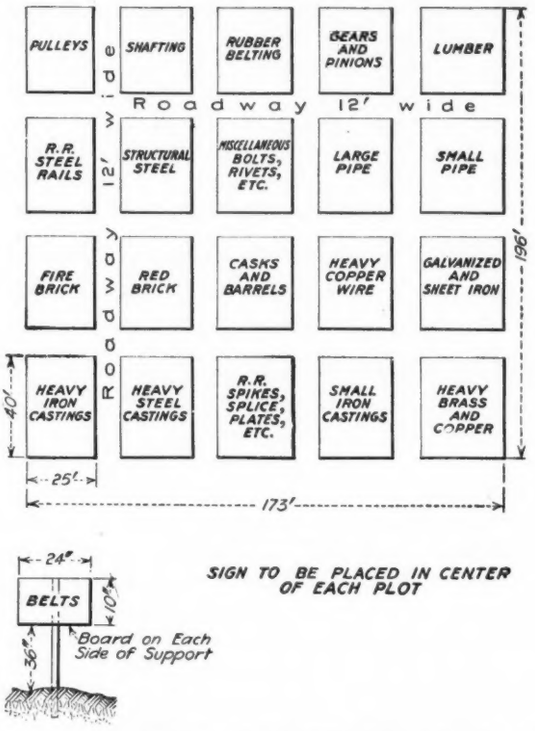


FIG. 2. ARRANGEMENT AND DETAILS FOR A SCRAP YARD

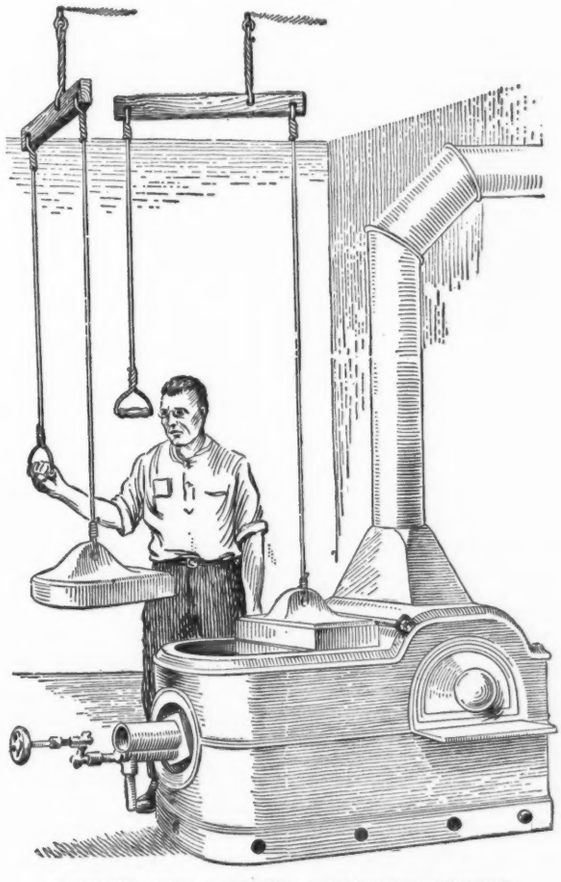
The Assayer and Chemist

Device for Lifting Furnace Covers

BY S. H. BROCKUNIER*

In the usual combination assay furnace the lids or covers of the crucible section supplied by the manufacturers are often frail and of short life. When they burn through, they can be profitably replaced by large slabs of soapstone or fireclay, which can usually be obtained at the nearest hardware store. These are durable and conserve the heat. The difficulty with them is that they are so heavy that they are not easily handled. I solved this difficulty in my own practice by rigging up a lever.

This consists simply of a piece of board 1 x 4 in. by 2 ft., bored with three holes as shown in the accompanying



DEVICE FOR LIFTING FURNACE COVERS

sketch. Baling or other wire is used for suspending it from the ceiling and for attaching it to the furnace cover. The holes should be so placed in the board that the center one will be 1 in. from the upper edge and the other two 1 in. from the lower edge. The longitudinal position of the central hole will depend on the weight of the cover; it must be sufficiently near the wire attached to the latter to make a gentle pull all that is necessary to lift the cover. The board should be hung a little to one side so that the slab will swing gently away when raised and rest on one edge of the furnace. With the handle in one hand, the tongs in the other will easily guide the slab in any direction. The wire may be attached to the cover by means of a bail, which acts like a pair of ice tongs. It is made of ¼-in. iron, the ends pointed to fit in holes cut in the edge of the slab above the center, so as to give better poise. They should be chipped out carefully just deep enough to hold; do not try to drill, but chip them out carefully with a nail and light hammer.

*Mining engineer, Nevada City, Calif.

Colorimetric Determination of Bismuth

BY HARRY A. B. MOTHERWELL*

No originality is claimed for the following method of estimating bismuth in refined copper, but it is submitted as a contribution that may be of interest to chemists. I am prompted to give it by the fact that after many years in different countries I have found it in use in only two places. Over 12 years ago it was employed at Wallaroo, South Australia, where possibly the process was worked out. A method employing the same principle but differing in detail was in use at the laboratory of the Tharsis company, in Glasgow, a number of years ago. Beringer, in his "Text Book of Assaying," gives a colorimetric method for bismuth, in which the solutions to be matched for shade are of a clear brown color. Health, in his "Analyses of Copper," refers to this method, but makes no mention of one using lead iodide. A method employing lead salts in the final solution has never been described in print to my knowledge. Matching light shades of yellow-brown in a clear solution is an operation of extreme delicacy; and it is a much easier matter to see a tint of brown against the pure yellow of lead iodide.

For this determination the following solutions are of convenient strength: Potassium iodide, 17 grams per liter of water; lead nitrate, 13.5 grams per liter of water; bismuth standard, 0.2324 gram bismuth nitrate, $Bi(NO_3)_3 5H_2O$, per liter. One cubic centimeter of the latter equals 0.0001 gram bismuth, so that if 10 grams of copper is taken for assay, each cubic centimeter required will equal 0.001% bismuth. The bismuth must be obtained in a solution free from copper, arsenic and iron and with a known amount of lead present. As the method is used for small quantities only, it is well to have a clear idea of the amount of bismuth present in the copper, so as to be able to weigh up a suitable quantity.

With this done, dissolve it in HNO_3, dilute and cool. Add Na_2CO_3 to precipitate a small quantity of copper, in the cold, and stir occasionally for six hours. Filter off the precipitate of copper, which will carry all the

*Trail, B. C.

bismuth. Dissolve in hydrochloric acid and precipitate with H_2S. Filter and wash well to free completely from iron. Dissolve the sulphide precipitate in HNO_3 and add 5 c.c. of the lead-nitrate solution. Precipitate by adding ammonia until solution is almost neutralized; then add an excess of ammonium carbonate. Boil, cool somewhat, add more carbonate and decant through filter. Dissolve in HNO_3 and repeat the precipitation. If the color due to copper is strong, add weak cyanide solution slowly until the blue has almost faded. Filter and wash free of copper. Wash the precipitate from the paper into a beaker and dissolve in the least quantity of weak HNO_3 by running the acid over the paper on the funnel and draining into the beaker with the precipitate.

Carefully evaporate to a syrupy state so that, on removing from the hot plate, the contents will crystallize. Cool, add three drops of HNO_3 and 5 c.c. of water, warm sufficiently to dissolve all crystals. Cool and pour into a Nessler tube up to the 25-c.c. mark. Add potassium iodide solution up to the 50-c.c. mark. Compare the shade with that obtained with the standard bismuth solution in the presence of 5 c.c. of the lead solution and an amount of HNO_3 similar to that in the beaker after evaporation. As the color darkens on standing, it is necessary to have several tubes of standards of different strengths prepared so that all shall be treated the same length of time. A good plan is to have the Nessler tubes in line and measure into each 5 c.c. of lead-nitrate solution and three drops of nitric acid; then into four of them put four different quantities of the bismuth standard solution.

To Determine Bismuth in Cathode Copper

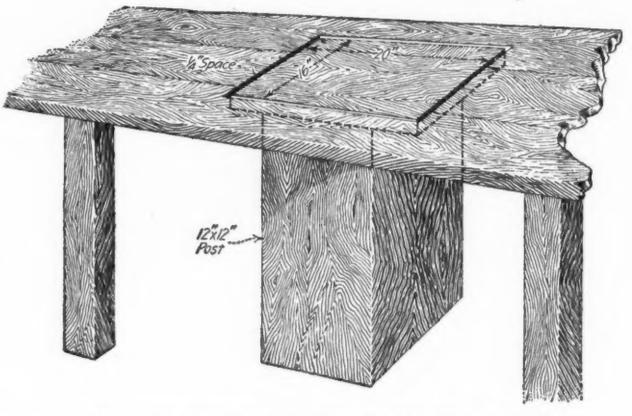
If cathode copper carrying about 0.001% of bismuth is being analyzed and a 10-gram sample has been taken, measure 0.6 c.c. of bismuth standard solution into No. 1 tube, 0.8 c.c. into No. 2, 1 c.c. into No. 3 and 1.2 c.c. into No. 4. Make all up to the 25-c.c. mark and then with the potassium iodide solution fill to the 50-c.c. mark at the same time that the tube containing the test assay is being filled. The color nearest to that of the test assay may be quickly picked out, the two tubes given a swirling motion and the color judged by looking down into them. As lead salts with potassium iodide give a pure yellow precipitate and bismuth salts alone give a brown coloration, it is essential to have the same amount of lead present in each tube; otherwise, for the same amount of bismuth, the one with most lead will appear lighter in shade. Warmer temperatures give lighter colors, apparently indicating lower results. Presence of HCl and NH_4Cl destroys the color.

If the HNO_3 solution is baked dry and then taken up with water only, the bismuth will not go into solution and on addition of potassium iodide a pure yellow will be obtained. If much antimony is present, it is rendered insoluble on evaporation to dryness with the HNO_3, thereby causing retention of some bismuth giving low results. If much arsenic, copper, or iron is present, it will tend to liberate iodine, causing high results, but if the solution is cool and no more acid used than recommended, small amounts will not interfere noticeably. An excess of HNO_3 or other oxidizing agent present will liberate iodine. It has been suggested to add sodium sulphite. This must be done carefully, as too much will produce a white precipitate and destroy the color of lead iodide, giving a lighter shade by dilution of brown with white and by deficiency of yellow.

The method is useful for detecting bismuth deposited with the copper in electrolytic determinations. The following has been found satisfactory: Treat the sample of cathode copper with HNO_3 and boil the solution. Dilute to about 300 c.c. Add 10 c.c. of the lead-nitrate solution and precipitate out the carbonate as described. Dissolve in HNO_3 and proceed as before.

Table for Assay Balance

Care is always taken in an assay office, or should be, to place the balance on a table or support so constructed as to be free from vibration. The special construction usually consists of heavy posts or columns supporting the table top and passing through the floor without touching it. This prevents vibration of the table due to any jarring of the floor, but unless the table is one of massive construction, as, for example, a slate slab on brick pillars, vibration or movement of the balance will be caused by touching or leaning on the table. To



BALANCE TABLE SECURE FROM VIBRATION

prevent absolutely all movement of the balance stand, and yet secure cheapness in construction, the table shown in the illustration was built. It consists simply of a small table top, 20 x 16 in., supported on a 12 x 12-in. post passing down through the floor with the lower end buried deeply in the ground. The hole in the floor is slightly larger than the post. Around this small table is built a larger one which is supported independently. Its size may be varied to suit conditions or requirements, and that of the small table top may be made to conform to the size of the balance used. This method of supporting is easily adapted to any number of balances in the weighing room and is more effective than the sign "Please do not lean on this table."

Lithium Hydrate added to caustic-potash solution in alkaline storage batteries increases both the available capacity of the battery and its internal resistance, according to L. C. Turnock, in a paper presented at the recent meeting of the American Electrochemical Society at Pittsburgh. Comparative tests of Edison storage batteries with 0, 10, 20, 30, 40 and 50 grams per liter of lithium hydrate added to the usual 21% caustic-potash electrolyte showed increased capacity up to 12% with the largest amount of lithium hydrate, in spite of a 21% increase in the electrical resistance of the electrolyte.

Events and Economics of the War

The Senate inquiry into the conduct of the war has begun; General Crozier, chief of ordnance, testified that delay in supplying equipment was due to the necessity of reorganization to equip a much larger army than that for which the department had been preparing; also in part to the need of supplying the Allies, and partly to the slowness of Secretary Baker in making certain important decisions. The Webb Export and Shields Dam bills have passed the Senate, the former going to conference and the latter to the House. The Senate resolution submitting to the states the constitutional amendment for nation-wide prohibition was adopted by the House. Austrians have been excused from registering as enemy aliens by the President's proclamation. Registration of men subject to draft began on Dec. 15. Steps have been taken by the Government to regulate prices as well as exports and imports of wool. Freight congestion and lack of coal east of the Mississippi have brought the question of road operation to a head; the President is expected to appoint a national traffic manager.

Abroad, German raiders sank one British destroyer and 13 merchantmen, aggregating 8000 tons, in the North Sea. Small gains have been by the Germans on the British front at Cambrai and Ypres. The Austrians also have advanced slightly against the Italian left. Cossacks and the Bolsheviki continue fighting in Russia, neither side having mastered the other. A state of war between Cuba and Austria-Hungary has been declared to exist by the Cuban Congress. The Canadian people on Dec. 17 reëlected the Union Government under Sir Robert Borden and voted for conscription; Quebec province was opposed to both.

Tax Burden Heavier in Civil War Than It Is Today

Despite the tremendous demands of war upon the United States, taxation is proportionately less today than in 1866, according to J. Rattray, of the war- and income-tax department of the Guaranty Trust Co. During the last year of the Civil War $1,800,000,000 was raised without resort to a foreign loan. This was hailed as an unparalleled triumph of financial strength.

"At that time," said Mr. Rattray, "the estimated wealth of the United States was about $25,000,000,000, compared with $250,000,000,000 in 1917, so that if we multiply these figures by 10 we should obtain an amount comparable to present conditions. On a similar basis the cost to us of the present war for six years would be about $40,000,000,000, and taxation would amount to about $5,500,000,000 per annum. Including loans to the Allies, our total indebtedness is now about $10,000,000,000, and additional taxes provided for in the War Revenue Act of Oct. 3, 1917, amount to approximately $3,000,000,000, in addition to about $1,000,000,000 formerly raised under our revenue acts.

"In addition to meeting some of the current expenses of the war, taxation must provide for interest charges on and amortization of our indebtedness. Additional taxes provided for would be sufficient to liquidate in 10 years the principal and interest of about $20,000,000,000 of indebtedness. As our expenditures in the first year of the war amount to about half this sum, it appears that for each year we are at war we must be prepared to support extraordinary taxation for a period of five years. A comparison with figures of 1866 will show that in proportion to our resources we are putting forth less of our maximum effort now than we did then."

Griesheim Chemical Works Destroyed

Griesheim Electron, near Frankfurt-am-Main, one of the largest chemical works in Germany, was reported destroyed by an explosion on Nov. 22. The plant covered 54 acres and produced a huge quantity of many different manufactures, including aniline dyes, nitric, sulphuric and other acids, phosphorus, alkali, liquid chlorine, oxygen and hydrogen. It supplied much of the electrolytic hydrogen used for inflating Zeppelins. It also played a leading part in the production of synthetic nitrates and in production of poisonous and asphyxiating gases, etc., it was one of the pillars of *schrecklichkeit*. Its output of poisonous gases was said to have reached in 1916 almost 600,000 cu.ft. per day.

The dispatches state that it was of first importance in its output of explosives and their ingredients and was said to be the only producer of saltpeter for making black powder, turning it out at the rate of 1000 tons per day. It supplied five nitroglycerine factories and two powder plants with all of the sodium nitrate and sulphuric acid that they used. Tonite, produced from picric acid, was one of its important products.

It was this company that produced the fused magnetite anodes originally used at the Chuquicamata plant of the Chile Exploration Co. It is understood that since the beginning of the war Duriron anodes have been used by the Chile company with success in place of those of magnetite. So important was the plant that its loss must inevitably be felt throughout Germany. The seriousness of the disaster is evidenced by the great care taken by the German government to suppress the facts.

Immigrant Influx Not Stopped by War

Labor conscription to prevent interference with war work is regarded as unnecessary by the Secretary of Labor, in his annual report to Congress. The extent of industrial unrest throughout the country since the beginning of the war is reflected in the amount of conciliation work done by the Department of Labor. From Apr. 6 to June 30, 1917, according to the report, such work affected 228,123 workmen directly and 178,376 in-

directly; from July 1 to Oct. 25, 1917, the number was 343,906 workmen, directly affected, and 202,578 indirectly. The statistics also show that the stream of immigration from Europe has not been entirely cut off by the war. During the year, 295,403 immigrant aliens were admitted, a decrease of 3423 compared with the previous year. Against this is recorded the departure of 66,277 emigrant aliens, a decrease compared with the year preceding of 63,488. The year closed, therefore, with a net gain of 229,126 in the number of immigrant aliens in the country.

Needs of the Railroads

There is some misconception as to the immediate requirements of the railroads in their present situation, according to Fairfax Harrison, chairman of the Railroads' War Board. The roads do not ask one billion dollars from the Government, declares Mr. Harrison. This amount is what ought to be spent annually for several years on railroad plant to bring it up to capacity for efficient operation. They do not consider necessary the repeal of anti-trust and anti-pooling laws to secure unified operation. They believe that the present system of voluntary unification is adequate for obtaining maximum efficiency.

The roads, on the other hand, do ask the immediate appointment of a traffic officer to represent all important Government departments in transportation matters, with whom the roads can deal, so as to secure Government coöperation and to avoid the excessive use of preference orders, which congest instead of facilitating traffic. The roads want priority orders issued to make possible the prompt delivery of new rolling stock still on order and greatly needed. They want Federal aid in securing for them, on their own individual credit, the capital necessary for enlarging their plant and for renewing maturing obligations. They want immediate increases in rates. Finally, they wish that drafted railroad men be enrolled and assigned to railroad work until actually needed for military service.

Poorer Coal Produced This Year, Though Tonnage Is Greater

In discussing the general need of fuel conservation in boiler rooms, Van H. Manning, Director of the U. S. Bureau of Mines, said that although it has been stated that 650,000,000 tons of coal will be mined in 1917, as compared with 600,000,000 tons in 1916, the coal produced this year may be less effective, because of higher ash, than last year's output—to such an extent, perhaps, that the apparently increased tonnage in 1917 may really represent an actual decrease in effective coal of 30 million tons below the 1916 production. Coal this year, according to Mr. Manning, has not been prepared as well as last year, and many cases have come to the Bureau's attention where coal normally 6-8% in ash is running 12 to 18%. Complaint about poor preparation, says Mr. Manning, is general, and it is not improbable that the 1917 production is 5% higher in ash than in former years. This being true, 32,500,000 tons of the estimated output of 650,000,000 tons represents nothing but increased ash.

In addition to this, Mr. Manning states, Government experiments have shown that for every 1% increase in the ash content the efficiency of coal drops 1½%. The extra 5% ash, mentioned above, represents, then, a reduction of 7½% in the efficiency of the remaining good coal, which, added to the 5% useless ash, makes a total reduction in effectiveness of 12½%. Figured thus, the 650,000,000 tons produced in 1917 is equivalent in fuel value to only 570,000,000 tons, a decrease of 30,000,000 tons below the 1916 production. This, added to our estimated increased needs of 100,000,000 tons, gives a deficiency of 130,000,000 tons to be made up by good engineering and more efficient fuel conservation in the boiler room.

In connection with Mr. Manning's statement, it is interesting to read the speech of David Moffat Myers on "Preventable Waste of Coal in the U. S." delivered at the recent New York convention of the American Society of Mechanical Engineers. Mr. Myers said in part:

> The saving or wasting of one-fourth of the coal consumption of any industrial plant depends entirely upon the efficiency of its operating management. . . . Under present conditions a plant which carelessly operates at an efficiency of 40 to 50% receives from the Government the same consideration in the delivery of coal as the one whose efficiency is 70 to 75%. This is obviously unfair as well as wasteful. . . . Six hundred million tons of coal were mined in the United States in 1916. If we assume only one-half of this to have been used for our industrial boiler plants, then a quarter of the coal used under boilers amounts to 75,000,000 tons per year. It is worth while to save this fuel by preventing its waste. It represents the use of 1,500,000 fifty-ton freight cars.

Strikes Hamper Airplane Work in Great Britain

The 50,000 British airplane workers at Coventry who recently struck have resumed work. They appointed a committee to settle questions in regard to shop stewards and the war bonus. It is estimated that the strike resulted in the loss of a million and a quarter working hours. The strike wave in the country appears to have amounted almost to insanity, according to the *Sun's* London correspondent. A number of metal workers, engaged in the manufacture of radiators, struck in sympathy with other members of the union who were striking for an increase in the wages of solderers and tinmen. The radiator workers, who were getting twice the sum, still are holding out. This fact means that the completion of many airplanes is delayed. Shop hands numbering 150,000 in the Birmingham and Midland districts demanded recognition of their shop stewards or said they would strike immediately. The majority of the shops are working on munitions. The Ministry of Labor is attempting to bring about a settlement, and negotiations are proceeding.

Miners' Wages in Germany

"While in upper Silesia the demands of the miners for increased pay may be considered to have been satisfied," says *Soziale Praxis* of Aug. 16 (translated by *Labor Gazette*, London, September, 1917), "in lower Silesia, Saxony, and upper Bavaria fresh demands have recently been put forward. In lower Silesia hewers were granted a wage of $1.68, and the workmen did not press for more, as the administration proved that the mines did

not pay. In the Oelsnitz-Lugau district the rate per shift was increased by more than 12c., and a new war bonus of 14c. was also granted. At upper Bavarian mines (Penzberg, Hausham Marienstein and Peissenberg) a hewer's rate of $1.54 was demanded, the rates of other work people to be increased in proportion. Besides war bonuses, a supplement of 30% on overtime and an increase of 50% on the Sunday-shift rate were also demanded. The employers refuse to grant the last named, as they consider this would encourage the practice of not working on Monday. The miners, however, still persist in all their demands.

"A large meeting of miners at Essen held recently showed that besides obtaining better conditions for their members, the trade unions have to bring about the recognition of the principle of negotiation. Herr Hue, a member of the *Reichstag*, and a local official of the Christian Trade-Unions, acting in concert, called upon the employers to abate their claim to be 'masters in their own houses.' They also directed attention to the increased number of shifts worked, and to the necessity of providing sufficient stores of food, especially of potatoes. At the same time the meeting declared its intention of increasing the existing output to such extent as may be possible."

Signs of Unrest Among Workers on War Orders

There is more unrest in factories working on direct war orders, the Department of Labor asserts, than in plants otherwise engaged, owing to the conviction of organized labor that the direct-war-order firms are taking excess profits. A statement to this effect is made by the department in a report on its two-months investigation into labor conditions in 37 cities in New York State. The war-order firms are employing 168,446 persons, of which 23,048, or 14%, are considered definitely necessary to the war industry. One firm requests the exemption of 13,323 men.

In the last two months 128 New York firms have asked for more help. The airplane industries' requests cover 57% of all the labor asked by these firms. Nearly two-thirds of the workers requested in the state are for skilled male labor; one fifth is for unskilled male labor and one-eighth is for women. In most cases where women have replaced men it was found that the former are given a piece rating, while the men are working for a fixed wage. The reports indicate that industries hard hit by the war are pleasure automobile parts, carpets, fine kid gloves, fancy sweaters, brooms and brushes, typewriters and high-grade woodwork. It is noted that workmen who are being laid off by these factories are readily finding employment in similar work.

Preparing for Next Liberty Loan

To perfect and coördinate the working of the various Liberty Loan organizations throughout the country for the period of the war a conference was held in Washington on Dec. 10 of representatives of Liberty Loan Committees from all over the country. Governors of the Federal Reserve Banks were invited to attend. Secretary McAdoo has announced that another loan will not be issued until some time after Feb. 1, but it is believed essential that educational work in preparation for future loans be kept up and the people of the country thoroughly informed of and impressed with the merit of Government securities, the individual advantages of thrift and economy, and the financial needs of America in the war against Germany and Austria.

Austrians Not Compelled To Register

The Department of Justice has abandoned its plan to register Austrians along with Germans because of the immensity of the task and the Administration's determination to minimize embarrassment to Austrians, thousands of whom have demonstrated their loyalty to this country by enlisting in the army and navy. In the proclamation on Dec. 12 declaring a state of war with Austria-Hungary, President Wilson specified that un-naturalized Austro-Hungarians, unlike the Germans in this country, shall be free to live and travel anywhere, except that they may not enter or leave the United States without permission, and those suspected of enemy activity may be interned. They need not register with police or post-office officials, as Germans soon will be required to do, are not barred from the 100-yd. zone about piers, docks, and warehouses closed to Germans, and are not required to leave the District of Columbia.

Webb Export Bill Passes Senate

The Webb export bill, to legalize combinations of American exporters in promoting their foreign commerce, was passed by the Senate, 51 to 11, on Dec. 12. President Wilson in his recent address to Congress urged enactment of the measure, which was passed in June by the House, and is now in conference. Business organizations have strongly supported the bill. Opposition in the Senate, led by Senators Cummins and Reed, was based principally on the argument that virtually it would repeal provisions of the anti-trust laws as to foreign commerce. The House previously passed similar legislation twice, but it failed in the Senate.

Technical Students Affected by Draft Ruling

The Provost Marshal General has sent the following telegram to the governors of all states:

Section 151, Selective Service Regulations, is amended by the addition of subparagraph D, as follows:

"Under such regulations as the Chief of Engineers may prescribe, a proportion of the students, as named by the school faculty, pursuing an engineering course in one of the approved technical engineering schools listed in the War Department may enlist in the Enlisted Reserve Corps of the Engineer Department, and thereafter, upon presentation by the registrant to his local board of a certificate of enlistment, such certificate shall be filed with the questionnaire and the registrant shall be placed in Class 5 on the ground that he is in the military service of the United States."

Ferrochrome may be used only in connection with high-speed, crucible carbon steel and alloy steel, according to an order issued by the British Government to manufacturers of steel in Great Britain. In alloy steel it may be used only when a priority certificate or other permit has been obtained warranting its manufacture.

Industrial News from Washington

BY PAUL WOOTON, SPECIAL CORRESPONDENT

Production of War Minerals Lags

In speeding up production of war minerals, the pace has not yet been reached that the country's natural resources and its engineering genius would seem to justify in time of emergency. This conclusion is reached by George Otis Smith, director of the U. S. Geological Survey, in his annual report. Dr. Smith said further:

Whoever studies the mineral resources of the United States and the industries built thereon must realize that in a time of need like the present year, production rather than price is the matter of prime importance; that a high price may both stimulate production and increase available reserves; that home production will result in transportation savings that are in reality a national benefit of practical value comparable with the theoretical advantage of industrial independence; and that expansion of productive capacity is possible under war conditions only as both consumer and producer can adjust their projects to the conditions that will prevail after the war, as well as to the needs of the present emergency.

The economy of domestic production wherever possible may be shown in the present manganese situation. The Virginia miner who loads on the cars 4500 tons of high-grade manganese ore this year is not only contributing to the steel industry that tonnage and receiving therefor compensation at the market price, but he thereby relieves the country's shipping shortage to the extent of one ship for 38 days, not including the necessary time for loading and unloading the cargo of Brazilian ore.

Opening pyrite mines must be based upon an assured supply of ore in the ground and an assured demand for the product for a period long enough and at prices high enough to justify the development. It is not enough for the geologist to point out the ore; the acid manufacturer needs to contract both to buy the pyrite and to sell the acid. New development must rest upon a basis of something more than risk, lest expansion of productive capacity involve after-the-war losses that will swallow up war profits. To make America industrially independent is an aim perhaps even more desirable now than three years ago, and possibly also even more of a problem than was then realized.

Mineral Import Committees Appointed

Committees representative of importers of all commodities requiring an import license are being designated. They will have no authority to grant or to refuse licenses. Their function will be to gather such information as the War Trade Board may direct; to act as consignee of the various imports requiring licenses; to release these commodities as directed by the War Trade Board; to obtain from importers such guarantees and agreements as the board may require; to keep informed as to the use and disposition of the imports within their jurisdiction, and to keep complete records of all importations of the various commodities requiring license. The American Iron and Steel Institute will act for the importers of tin, tin chloride and tin ore. Graphite importations will be supervised by a committee from the Plumbago-Graphite Association. Other minerals for which import licenses are required and for which committees are to be appointed in the near future are: Antimony, asbestos, chrome, cobalt, all ferroalloys, iridium, manganese ore, molybdenum, emery, nickel, sodium, potassium and calcium nitrates, platinum, pyrites, titanium, tungsten and vanadium.

One Hundred War Service Committees Must Be Formed

The work of the Council of National Defense and of the War Industries Board is being retarded by the difficulty in reaching industries as a whole. This situation, however, will be met to a large extent by the formation, through the agency of the National Chamber of Commerce, of war-service committees that will be representative of the industries. A few have been approved by the chamber's central committee. The lumber industry, represented in Washington by five bureaus, will continue to coöperate with the Government. S. T. Henry, of the Allied Machinery Co. of America, is coöperating with the chamber in an effort to form a committee representative of all manufacturers of machinery. In all, nearly 100 committees must be formed. Owing to the difficulty of securing men whose circumstances are such as to make it possible for them to assume the duties involved, and who will be acceptable to the various industries, it will be some time before the work is done.

Broaden Work of Urbana Station of U. S. Bureau of Mines

The experiment station at Urbana, Ill., of the U. S. Bureau of Mines, will hereafter be headquarters for the work carried on in both coal and metal mining, and in the metallurgical industries in the general Middle West district, including Illinois and surrounding states. The present work of the station relating to the improvement of safety conditions and practices in mining will be continued and studies of technologic problems in both coal and metal mining and in the metallurgical industries of the region will be pursued. The existing coöperative agreement with the University of Illinois, through its mining department, and with the Illinois Geological Survey, has been renewed. New work concerning mining practice and utilization of the Middle-West coals in coke and gas manufacture is under way.

Cyanide Outlook Brighter

An adequate supply of ammonia having been assured them, producers of cyanide expect to manufacture enough to meet the normal demands of the United States and Mexico. The limiting factor in cyanide manufacture has been the ammonia supply. The demands made by the munitions, textile and refrigeration industries have been heavy enough to reduce considerably the amount of ammonia available for other industries requiring it in their work.

Oil Land Leasing Bill has been placed before the Senate by Senator Pittman, of Nevada. During the various sessions at which this measure has been considered, it has never been brought before the body so early before. Thus a vote on the bill is assured.

Editorials

Fixed Prices and Short Supplies

THE coal crisis is here, and the efforts of Doctor Garfield to explain it are pathetic. He is not responsible for it and he cannot do much to ameliorate it. The responsibility lies deeper. It is to be found in the policy that has starved the railways and the more recent meddling with the laws of economics. Washington has been obsessed with its ideas of price-fixing and annulment of the law of supply and demand. It has not annulled that law and cannot do so, any more than it can abolish the law of gravitation; but it can supersede the principle of *laissez faire*, as it has done. A corrollary of *laissez faire* is survival of the fittest. Now, we admit the teachings respecting modified *laissez faire* as compared with the unlimited, and recognize that in the present world-wide confusion there is necessarily more control than in normal times. With shortage of foodstuffs *laissez faire* would mean starvation of the weak and poor and survival of the rich and strong, a condition that ought not to be permitted, and is not.

The exercise of control of commodities is a different thing. Deprivation of any one of them is not such a vital matter as in the case of food that people must have from day to day, else die. But nobody suffers directly if the price for lead soars to 12c. per lb. People simply cease painting their houses and curtail their expenditure of shot in gunning. The market dictates who shall have things and who shall not, swiftly, quietly, automatically, and according to the consumers' own wishes. The market in myriads of commodities is in balance.

Artificial control of those myriads of commodities is beyond comprehension. The exercise of control in a few of them unbalances the whole structure and inevitably produces trouble. The United States has been trying the experiment for only a few months, and in only a few things. There is a curious significance that in those very things—copper and coal especially—there has been shortage of supply. There is no particular good in having a restricted price for coal and not having coal enough. Everybody would be happier and our progress in warfare would be speeded if we had more coal, even if we had to pay more for it.

The Position of the Gold Mines

THE communication of J. Parke Channing in the *Journal* of Dec. 8 on the subject "Is Gold Mining Necessary During the War?" has excited a good deal of discussion. Mr. Channing took the position that we do not need any more gold, and therefore the continued operation of gold mines simply uses labor and material that ought to be employed for more essential things. Anyhow, he argues that Congress should frown upon the movement to assist gold mining in the present juncture by abating war taxes in so far as the gold mines are concerned.

We do not hold with Mr. Channing. If it had not been for the great gold reserves of Great Britain and the United States, we fear that the Huns would already have been overrunning our shores. The British have recognized the importance of maintaining their financial basis, and have done everything possible to stimulate the gold production of the Witwatersrand. Otherwise the statements of the Bank of England would look very different today. Even now the bankers of both Great Britain and the United States are distinctly averse to releasing any of their gold. The Director of the Mint has just stated officially that it is desired to encourage the production of both silver and gold.

The production of silver may be stimulated by letting the price rise further, but the price for gold does not rise. On the contrary, as the prices for other commodities rise, the value of gold depreciates, i. e., it will buy less of other things. For this reason gold mining is now on the wane. The cost of production has so increased that in many cases inability to operate any longer at a profit is immediately threatened. The more favorably situated concerns are confronted by heavy war taxes. They have not enjoyed any war profits. On the contrary, they have suffered war losses. It is certain that if maintenance of gold production be desired, something must be done to ameliorate the conditions under which gold producers are operating.

Negotiations Respecting Silver

THERE has been considerable talk in the newspapers lately about fixing the price of silver, etc. None of the reports printed has been correct. Negotiations are being carried on, in which the Western silver producers are represented by a committee headed by Governor Boyle of Nevada, but no conclusion has yet been reached. Meanwhile, the old specter of bimetallism has appeared, and Senator Shafroth, of Colorado, has introduced in Congress a resolution that is reminiscent of 1893. The confusion in regard to the matter induced the Director of the Mint to make the following official statement on Dec. 15:

> Reports recently have been circulated that negotiations of the Government in relation to silver are designed to revive a discussion of the issues involving bimetallism and the free and unlimited coinage of silver.
>
> I desire to state emphatically that the sole purpose of the Government is to insure an adequate supply of silver at a price which will be fair to the small producer as well as to the large operator, which will stimulate the production of silver and gold and other metals yielding silver as a by-product, which will stabilize the American silver market, which during the last two years has been subject to fluctuations, and which will render foreign exchanges more stable. The negotiations afford no opening for a revival of economic issues and should be regarded purely as an effort to secure an adequate supply and to place American silver production and manufacture on a more satisfactory and scientific basis.

The Director of the Mint has outlined what is in mind. The project that is contemplated does not in any way savor of bimetallism.

Government Railway Control

BEFORE this page is printed some system of Government control of the railways of the United States will perhaps have been announced. Once introduced, we shall never return to the present system of private operation, although the war-time plan is likely to be modified with the return of peace. Thus we are about to see the end of the long contest over the railways and the beginning of a new era in their operation. It is regrettable that the breakdown of the railways, which is the direct result of their starvation by politicians, had to come in this crisis. Yet otherwise the contest might have been protracted so much longer that perhaps it is best to have it ended.

Governmental control will be advantageous in many ways. There will no longer be trouble in financing. Freight and passenger traffic will be routed in the most economical way. There will be an enormous saving in accounting. The abolition of the expense of dealing with the Interstate Commerce Commission will be no mean saving in itself. Yet it does not follow that the public will get cheaper transportation, not even after the war. The brotherhoods, the *imperium in imperio*, will have something to say about that. And it is all but certain that the public will not get the conveniences that resulted from competition.

During the war Government operation of the railways will surely be efficient, for it will be left practically in the hands of the present managers. After the war we shall fear the hand of politics and the incompetence that characterizes the operation of the great Government monopoly—the post office. But it may be that after the war we shall have a different breed of politicians. Their present contact with the dollar-a-year men ought to have some effect.

The Situation in Washington

LAST Thursday there was in Washington a second editorial conference of the business papers of the country. Like the first one, last May, the purpose of this was to give the editors an opportunity to learn directly from department heads and bureau chiefs what is being done and to give those heads and chiefs a chance to communicate to the most intelligent class of readers information concerning the things in which public cooperation is needed. The several addresses at this meeting were of a high order of interest, and all attending thought the conference well worth while.

We ourselves came away, however, with a certain feeling of depression, reflecting probably ideas of the chaos that still exists in the administration of war affairs. Without doubt a great deal of work has been done, and most valuable work, but there is, alas! much evidence of absence of coördination, lack of team-work. It is, for example, a shock to hear expression of the opinion that more of a costly, bulky class of machinery is being manufactured than we shall probably ever be able to transport to France; and then to hear from another speaker complaint of the shortage of coal, iron and labor. The idea occurred to us that if all of the heads and chiefs had been required to attend such a conference as we did, and to remain there, hearing each other speak, it would have been a good thing.

Privately we learn of important matters stalled in the departments; of documents pigeon-holed; of vital actions ordered without learning how other branches are affected; of ignorance to what quarter important things should be referred, and so on. The revelations of General Crozier to Congress with respect to the rifle and machine-gun supplies are spectacularly illustrative. Somebody else has aptly remarked that the most lingering impression that an outsider gets after visiting the several Governmental departments is the absence of a real manager in each.

Lead Not To Be "Regulated"

The decision of the War Industries Board, after the conference with the lead producers on Dec. 17, not to undertake any regulatory action affecting their industry at this time exhibits commonsense. Lead is at present in rather a depressed condition, and the market for it will undoubtedly behave in a natural way if it be let alone. The experience of the Government in fixing the prices for copper and coal, with the immediate results of shortage of supplies, and in the case of coal great suffering to the people and crippling of war work, ought to be a lesson to Washington, even to the highest quarters therein, that attempts to baffle a law of nature are bound to incur a penalty.

The showing of the men of the United Eastern gold mine at Oatman, Ariz., in subscribing to the recent War Loan was commented upon in the report of the Arizona chapter of the American Mining Congress. Out of 205 employees 107 subscribed to the loan, which is said to be a record percentage for any Arizona mine of the first grade. General Superintendent J. A. Burgess of the United Eastern naturally felt pride in the subscriptions of his men and the loyalty expressed, and did not fail to give them the satisfaction of knowing that their attitude was appreciated. Besides making record of the names of all the subscribing employees for future reference as an honor list, he sent each a letter of personal thanks. "The subscriptions show," says the letter, "that the men of Oatman fully understand their responsibility to support the Government and the soldiers in this grievous war. Before it is over we shall doubtless be called upon to do many unusual things and make many sacrifices, among which will be the investment of our savings in bonds, and the conservation of food. Let us respond as whole-heartedly to each appeal as we did to the recent loan."

Each operator, from the "big boss" down, can increase his initiative and his ability by getting in touch with what the other fellow is doing. Mining, like everything else, is not made up of one idea—it's the combination of a number of them. We all have our own way of doing things. Sometimes that way is a good one and sometimes another fellow has a better method—if we only knew it. But the main thing is the interchange of ideas and the proper medium. No finer expression of good will can be made to your responsible men than to present them with a year's subscription to the paper that is published to help them to improved and economical results in their work. And what gives more assurance to a chap than to know that the company for

which he works is interested in him? Most holiday gifts are outworn and forgotten in a few months; but here is one that lives and grows with each week. We have prepared an appropriate card to announce that the *Engineering and Mining Journal* will be mailed to the recipient in 1918, with the compliments of an appreciative superintendent or manager. The time is growing short —let use have your list without delay.

BY THE WAY

The *South African Journal of Industries* is the title of a new publication issued from Pretoria under the direction of the Hon. F. S. Malan, Minister of Mines and Industries. It contains a number of interesting and authentic articles concerning the industrial and mining development of this great empire. Unfortunately, as we commented a few weeks ago, the mineral production is reported in terms of value, after the manner of some state mining bureaus, which permits no intelligent comparison with previous years.

"Liberty bonds"—so-called—are being sold by the I. W. W. members to various radical and labor organizations throughout the country, according to the *Tribune*. The object is to raise sufficient funds to bail those I. W. W. members who have been placed in jails for alleged conspiracies and sabotage activities. A defence committee has been organized for this purpose and special efforts are being made to help the 166 members and sympathizers of the I. W. W. who are now under indictment at Chicago. The committee in charge is called the General Defence Committee, and has offices in Chicago.

The mining regiment, the 27th Engineers, wishes to enlist some first-class cooks and assistants—what are usually referred to in the diggings as "bull cooks" and "cookees." If it were possible to use Chinamen, we would recommend the Silver King crew *en masse*. At least we would if the same crew is presiding over the destinies of the inner man as was the case at this Park City mine 10 years ago. At that time it had a mess unexcelled at any mine in this country and equaled by few. It was a privilege to work at the Silver King in those days, and we hope that "Coalition" has made no difference in this respect. However, to get back to cooks for the mining regiment, "Who has a good cook?" And enough patriotism to give him up? See advertisement on page 47. But they should be good cooks. We want the boys in the mining regiment to be cheerful, and, aside from hard work, there is nothing like good cooks to make the boys take a real interest in dinner. And we suppose these cooks should be able to make good pasties, for we understand there will be some Michigan boys in that regiment, and they will want to be reminded of home occasionally. Well, if you can't send your cook, you might join the Comfort Club and help to keep the boys in Peerless and other comforts.

He brought home the bacon. "In boxes, carried as luggage, F. W. Draper, an American mining engineer, arrived at a Pacific port from Russia with nearly $2,000,000 worth of platinum," says an Associated Press dispatch. "The metal, amounting to about 21,000 oz., was consigned to the Secretary of Commerce and is urgently needed for war purposes. Draper traveled across Siberia alone and unarmed. At Vladivostok he took ship for America, arriving safely last week with his precious luggage." From subsequent dispatches we glean that American engineers in Russia have not been idle since their country entered the war. "Realizing the necessity of obtaining platinum if American war preparations were not to be hindered, negotiations were entered into for securing a large supply of platinum from Russia, the principal source of this metal. Lieut. Norman C. Stines, a well-known placer engineer, formerly associated with Herbert C. Hoover, and more recently attached to the military staff of the American Embassy at Petrograd, began quietly to obtain control of supplies of platinum with the financial assistance of the Russian-English Bank of Petrograd. This platinum was offered to the United States Government at cost and consigned to the Secretary of Commerce with the understanding that it was to be used solely for Government needs." What other engineers assisted in the collection and forwarding of this precious consignment the dispatches do not state, but we are confident that every American engineer in Russia has been doing his utmost in aiding the cause of real democracy.

A presumptious exponent of "freedom" on the Russian front, says an Associated Press correspondent, was recently disposed of by Klondike methods as exemplified by Lieut. Col. John W. Boyle, Jr., of the Canadian militia, who was sent by the American Committee in London to aid in restoring the Russian transportation system. Lieut. Col. Boyle, who was formerly assistant general manager of the Canadian-Klondyke Mining Co., has been engaged for four months in improving the transport conditions along the Russian and Rumanian fronts. At a certain point the chairman of a soldiers' commission, to whom Boyle was referred for necessary information, met him in an uncivil mood, and impertinently answered one question with another calculated to rouse the Canadian's temper. "Were you sent here because you were the best man they could find on the French front?" queried the nagging committeeman through an interpreter. "Possibly so," was the reply. "Now, answer me this: Are you the best man in your committee?" "I am." "What is your rank?" "I am a soldier." "It is unbecoming in me to start an argument with a soldier," said Boyle, who saw that he must either subdue his antagonist or fail in his quest. "But this is what I propose to you. I take off my uniform," proceeding in the meantime to lay aside his cap, 'harness,' and uniform coat, "and meet you man to man. Now you name any job that you think you can do better than I can, from lifting or jumping to fighting, and I will take you on." The interpreter conveyed this information to the soldier-committeeman. "Tell this chap," continued Boyle, "that if he fails to best me in whatever he chooses, he must go away from here and not interfere in my affairs, or I shall give him the best beating he has had since he was a child." The bully held a brief conference with his fellows and went away. He may have had an inkling, continues the Associated Press story, that Boyle was once the heavyweight boxing champion of the Canadian Northwest.

Metal Exports in October

WASHINGTON CORRESPONDENCE

Sulphuric-acid exports in October were 4,492,200 lb., an increase of more than 1,000,000 lb. over exports in October, 1916. The exports of sulphuric acid for the first 10 months of 1917, which were 53,487,786 lb., were approximately 4,000,000 lb. behind those of the corresponding period of 1916. These and the following figures are taken from the returns to the Bureau of Foreign and Domestic Commerce.

Exports of refined copper are outstripping those of 1916. In October, 1917, 81,316,000 lb. of refined copper was exported. In the corresponding month of 1916 exports were 55,303,187 lb. For the first 10 months of this year, exports were 870,746,395 lb. During the first 10 months of last year, exports of refined copper were 610,971,657 lb. Exports of copper ore in October, 1917, were 435,700 lb., as compared with 1,005,764 lb. in October, 1916. Copper ore exported during the first 10 months of 1917 aggregated 4,100,576 lb., as compared with 3,975,778 lb. during the same period of 1916.

Owing to a demand for a more detailed classification of zinc exports, the statistics of the Bureau of Foreign and Domestic Commerce are now being compiled so as to show exports of zinc ore, zinc dross, spelter obtained from domestic ores, spelter obtained from foreign ores, zinc sheets, other manufactures of zinc and all other articles of zinc. The change in classification has caused delay in the preparation of comparative figures with the exports of last year. Exports of zinc ore were negligible. Zinc dross to the extent of 2,462,085 lb. was exported in October, and for the first 10 months of this year the exports were 20,530,634 pounds.

Lead exports increased decidedly in October, 1917, as compared with that month of 1916, but the movement abroad for the first 10 months of 1917 is far behind that of the same period last year. Exports produced from domestic ores in October, 1917, were 21,039,360 lb. From foreign ores the total was 5,329,408 lb. For the corresponding month of last year the figures were 18,792,429 lb. and 1,097,672 lb. For the 10 months of 1917 total exports from domestic ores were 82,535,280 lb. and from foreign ores 33,489,641 lb. The extent of the falling off is shown by the fact that the exports from domestic ores for the first 10 months of 1916 were 176,393,359 lb. Exports produced from foreign ores showed an increase over those exported in the first 10 months of 1916, when 16,244,637 lb. was forwarded. Imports of lead from Mexico during October were 3,941,213 lb., which is only a slight increase over the imports of October, 1916. The imports for the first 10 months of 1917, however, were 78,783,437 lb., which is more than double the Mexican imports for the corresponding period of 1916.

Manganese imports continue to run well ahead of those of 1916. In October, 1917, shipments from other countries totaled 60,649 tons. The total amount of imports for the year up to the first of November was 555,282 tons. At the corresponding time in 1916, 495,300 tons had been brought in.

Importation of pyrite is falling behind the average of 1916. At the end of October, 1916, the monthly average was slightly more than 100,000 tons. During the first 10 months of 1917, the monthly average was 78,567 tons. That average was exceeded in October, 1917, however, when the total imports were 94,119 tons.

Imports of tin are slightly in excess of those of 1916, due largely to the heavy imports in October, when 10,628,102 lb. was brought in. Imports for the 10 months ended Oct. 31, 1917, were 126,125,792 lb. For the corresponding period of 1916 imports were 121,048,537 pounds.

Who Dictated the Coal Shortage?

(New York Sun)

It is nonsense to try to explain away the coal shortage, and the peril to human life occasioned by that shortage, by alleging either military necessity or economic conditions, or, again, the act of God.

As is always the case when human authority undertakes not merely to supplement but to supplant the natural laws of supply and demand, the responsibility for a great failure, murderous in its possibilities, is personal and individual. It goes back directly to the incapacity or the lunkheadedness of somebody, somewhere—some individual or individuals.

The plainest and most urgent duty of an investigating Congress is to discover the somebody, to locate the somewhere. The Senate Committee on Manufactures, which is already concerning itself with the achievements and deficiencies of food and coal dictatorship, cannot address itself too promptly or too vigorously to this immediate task.

Turn on the light, first of all, on the blunderers who are capable of turning off the heat, in blizzard or near blizzard weather, from a city of five millions of people! Let there be no chance of a repetition of Saturday's and Sunday's experience.

Turn on the light, first of all, on the origin and creation of a coal famine throughout a country blessed with coal to burn for hundreds or thousands of years to come.

Merrill Regulating Arsenic Industry

WASHINGTON CORRESPONDENCE

The arsenic industry was placed under the direction of the Food Administration on Nov. 15, since which time efforts have been made to collect statistics regarding the metal, exact information of this nature being scarce. With the matter practically settled of determining reasonable profits for producers and others engaged in the arsenic trade, C. W. Merrill, head of the chemical division of the Food Administration, is now turning his attention to those industries which may be called upon to lessen their consumption of arsenic.

To provide sufficient arsenic for all necessary uses of insecticides and to maintain a stock adequate to protect crops against the sudden coming of any insect plague, some curtailment will probably be necessary in its consumption for less essential purposes. It is believed, however, that such reduction can be made without seriously disturbing any industry. This is particularly true in glass making which consumes one-third of the arsenic production. An increasing drain on the scant supply of arsenic is caused by its use in making poisonous gas for military purposes. Control of the

arsenic situation has been simplified by licensing wholesalers and jobbers and by the securing of priority movement of the metal from points of production. At the request of Mr. Merrill, mining companies, both in the United States and in Mexico, are endeavoring to make a greater saving of this substance.

Foreign Trade in Lead and Zinc

Imports of lead and zinc during August, September and the first nine months of 1917 are reported by the Department of Commerce as follows:

Articles and Countries	August Contents, Lb.	September Contents, Lb.	Jan.-Sept. Contents, Lb.
Lead Ore:			
Canada	.....	21,795	7,994,322
Salvador	.....	.....	3,117
Mexico	748,462	937,633	12,300,847
Chile	.....	.....	1,194,749
Peru	.....	.....	348,072
Italy	.....	.....	46,719
England	.....	.....	8,609,804
German Africa	.....	.....	4,405,145
France	.....	.....	120,102
Panama	.....	.....	6,084
Others	.....	.....	2,491
Totals	748,462	959,428	35,031,452
Lead—Base Bullion and Bullion:			
Dutch East Indies	505,064	229,090	837,028
Peru	.....	14,058	64,443
Canada	.....	139,033	1,304,964
Mexico	13,046,929	10,076,266	62,541,377
Totals	13,551,993	10,458,447	64,747,812
Lead—Pigs, Bars, etc.:			
Panama	14,688	938	61,076
Barbados	.....	.....	2,814
Colombia	.....	.....	3,155
Haiti	211	420	39,133
Canada	2,632	.....	330,414
Guatemala	.....	.....	52,400
England	.....	.....	80,188
Mexico	1,221,930	1,555,533	5,065,272
Peru	8,936	.....	18,948
France	.....	.....	89,086
Chile	.....	.....	8,769
British West Indies	13,867	.....	27,313
Others	.....	2,305	9,391
Totals	1,262,264	1,559,196	5,787,959

The gross weight of lead ore imported in September was 3032 long tons.

The actual tonnage of zinc ore imported in September amounted to 9749 long tons. The countries of origin and the metal contents were as follows:

Countries:	August Contents, Lb.	September Contents, Lb.	Jan.-Sept. Contents, Lb.
Canada	1,672,827	964,000	7,390,789
Australia	.....	.....	23,427,162
Mexico	8,343,275	6,924,290	79,001,950
Spain	.....	.....	12,166,840
French Africa	.....	.....	1,245,000
Italy	2,000,000	.....	4,822,400
	12,016,102	7,888,290	128,054,141
Zinc in Blocks, Pigs, etc.:			
Costa Rica	.....	312	7,315
Panama	4,281	19,956	48,730
Cuba	12,817	8,787	255,539
Mexico	.....	.....	3,318
Ecuador	.....	.....	7,580
Canada	14,619	.....	31,805
Brazil	.....	.....	5,513
Colombia	.....	.....	6,000
Jamaica	.....	.....	2,165
Others	2,273	.....	4,035
	33,990	29,055	372,000

Exports of lead and zinc were as follows:

Lead:	August Contents, Lb.	September Contents, Lb.	Jan.-Sept. Contents, Lb.
Pigs, bars, etc., produced from domestic ore	3,810,021	8,692,397	77,205,872
Pigs, bars, etc., produced from foreign ore	178,301	207,322	12,450,281
Zinc:			
Pigs, etc., produced from domestic ore	18,322,974	13,619,619	222,570,009
Pigs, etc., produced from foreign ore	1,515,071	39,249,110	106,021,194
Sheets, etc	4,242,651	3,878,504	23,319,504

Legislation looking to the stimulation of domestic mineral production is being considered by the House Committee on Mines and Mining. A bill to this end probably will be introduced by Representative Foster upon the reconvening of Congress after the holiday recess.

Comfort Fund for the 27th Engineers Climbing Rapidly

The Comfort Club fund for the 27th Engineers has passed the $4600 mark. This is a good beginning and encourages us to hope that a great success will crown the effort to raise a fund for the mining regiment. The list of contributions to date is as follows:

CONTRIBUTIONS TO THE COMFORT CLUB

"Engineering and Mining Journal"	$1000.00
New York Engineering Co	1000.00
A Friend, Nov. 23	5.00
H. H.	5.00
D. E. Charlton	5.00
H. W. Hardinge	1000.00
Frank N. Spencer	5.00
W. L. Coursen	5.00
J. H. Polhemus	5.00
J. H. Janeway	10.00
Albert D. Beers	10.00
J. E. Hayes	10.00
J. A. Van Mater	25.00
L. Vogelstein & Co	100.00
"Cuprite"	10.00
R. H. Bassett (Hanna Ore Mining Co.)	10.00
A Friend, Dec. 10	10.00
P. A. Mosman	10.00
American Zinc, Lead and Smelting Co	100.00
J. G. H.	5.00
A Friend, Dec. 13	50.00
Daniel Guggenheim	100.00
Willard S. Morse	25.00
August Heckscher	100.00
Anaconda Copper Mining Co	1000.00
Total	$4605.00

The mining regiment and the Comfort Club are both new to the mining industry. The war has produced the unusual in many forms. We are being asked daily to do things unheard of a few years ago. That we would ever engage in a European war itself seemed unthinkable and the possibility that American miners would be called on for service abroad was never dreamed of. There have been other wars and other volunteers before now in our history, but this war is unique in the specialization it demands. So it is that we have railway regiments, lumberjack regiments and, newest of all, the mining regiment, the 27th Engineers. Men are pouring into Camp Meade, in Maryland, from hundreds of scattered camps to form this regiment, and soon it will be on its way to the front. The men have left their homes behind, but the home worries will go with them across the water. What are we going to do about it? What are *you* going to do about it?

The Comfort Club exists to make life as comfortable as possible for these men. To achieve this we must do more than furnish tobacco, cigarettes, etc. We must make the men feel that all is well with their families back home; that there are those who have a friendly interest in them and are ready to help quickly in any way that may be needed. Otherwise the morale of the men may weaken. The extent to which such service may be rendered will depend on the size of the fund available. All can help—all should help. The Twenty-Seventh is peculiarly your own regiment, made up of friends, acquaintances and recent fellow-workers.

Mr. Manager, after you and your company have subscribed to the Comfort Fund, keep the ball rolling. Interest your men in it. Keep it fresh in their minds. The Fund has no limit. There can be no limit. It must be continually replenished as fast as it is spent. The officers of the regiment, headed by Maj. O. B. Perry, will aid in administering it. Make your checks or orders payable to the *Engineering and Mining Journal* and watch the next issue to see them acknowledged. Remember the men in the Twenty-Seventh.

Personals

Leighton Stewart is examining mining properties in British Columbia and will be gone approximately one month.

A. J. Eveland, of New York, sailed last week for South America, where he will be engaged in field work for several months.

S. H. Hamilton, of Philadelphia, is directing the mining and milling operations of the Carolina Chrome Co., of Waynesville, North Carolina.

D. C. Jackling has been appointed by Secretary Baker to take charge of the construction work of Government explosives plants, involving an expenditure of $90,000,000 or more.

P. G. Beckett, general manager of the Old Dominion Co. at Globe, Ariz., has been appointed an assistant to the president of the Phelps Dodge Corporation. He will make his headquarters at New York.

Morril B. Spaulding, who has been associated with the U. S. Shipping Board Emergency Fleet Corporation, at Washington, D. C., is now assistant engineer with Chester Shipbuilding Co., Ltd., at Philadelphia, Pennsylvania.

E. M. Dunn, who has been for several years in the laboratory of the Washoe smeltery of the Anaconda Copper Mining Co., at Anaconda, Mont., has accepted a position with the U. S. Bureau of Mines and left Anaconda, Dec. 11, to assume his new duties.

W. H. Armstrong, of Vancouver, B. C., government director of coal operations, has been appointed a commissioner to investigate the labor dispute between the Consolidated Mining and Smelting Co. of Canada, at Trail, B. C., and its employees, which had resulted in the stoppage of the metallurgical operations.

Charles T. Bragg will take the position of works manager of the Detroit plant of the Michigan Smelting and Refining Co. on Jan. 1, 1918. Mr. Bragg is a past president of the Detroit section of the American Chemical Society. He has been chemical engineer of the Ohio Brass Co. for six years and was for over four years technical director of Berry Bros., of Detroit.

Charles A. Piez, president of the Link-Belt Co., who was recently made vice-president of the Emergency Fleet Corporation in charge of shipbuilding, has been appointed general manager of the latter corporation, succeeding Admiral Frederick R. Harris, resigned. Since his graduation from the Columbia School of Mines in 1889, Mr. Piez has been connected with the Link-Belt Company.

Robert K. Tomlin, Jr., managing editor of "Engineering News-Record," sailed recently for France to serve that and the other papers of the McGraw-Hill Publishing Co., Inc., as special correspondent at the front. Mr. Tomlin was graduated from Harvard University in 1907. After graduation he entered the employ of the Pennsylvania R.R. on the tunnel work in connection with the Pennsylvania Station in New York. He left this work to go to the New York Board of Water Supply, and was stationed with the northern aqueduct department at Poughkeepsie, N. Y. His journalistic experience dates from March, 1909, when he became assistant to the editor of the "Engineering Record." He was subsequently made associate editor, in charge of the municipal and sanitary field, and in 1913 was promoted to managing editor. When "Engineering News-Record" was formed last April by the consolidation of "Engineering News" and the "Engineering Record," Mr. Tomlin was made managing editor.

Obituary

James Sheakley, the first Governor of the Territory of Alaska, died at his home in Greenville, Penn., on Dec. 10, aged 90 years. He was one of the pioneer oil men of the Western Pennsylvania field. In 1874 he was elected to Congress and two years later was one of the leaders in the Hayes-Tilden Presidential election contest. After serving for several years on the Alaskan Commission he was appointed Governor of Alaska in 1893 by President Cleveland.

Lieut. Benjamin Walcott, son of Charles D. Walcott, secretary of the Smithsonian Institution at Washington, D. C., and formerly Director of the U. S. Geological Survey, has been reported killed in France. Lieut. Walcott, who was an American aviator, successfully brought down his adversary in his first encounter. While returning, however, he was attacked by three German machines; his airplane was seen to fall. He was 21 years old and was graduated from Princeton last spring.

Societies

Montana Society of Engineers held its December meeting in Butte on Dec. 10, at the Society's rooms. A paper was presented by Theodore Simons, entitled: "A Coöperative System of Engineering Education." An informal report on copper mining in the Belgian Congo was made by Robert M. Johnson, an engineer in the employ of the Katanga mines.

Northwest Mining Association—Frank C. Bailey, secretary of the association, has commenced active work for the annual convention which will be held the week of Feb. 11 to 19, 1918. He has opened correspondence with mining men and prospectors all over the Northwest, urging them to send samples of ore to be placed on exhibition. Arrangements have been made to have the samples shipped without freight charges.

Colorado Chapter, American Mining Congress, has elected the following officers: Bulkeley Wells, governor; J. F. Welborn, first vice governor; R. S. Ellison, second vice governor; S. D. Nicholson, third vice governor; Irving T. Snyder, treasurer; and M. B. Tomblin, secretary. A committee composed of George L. Nye, W. B. Hodges, A. E. Humphreys, John T. Barnett and L. L. Aitkin has been sent to Washington, D. C., to confer with the executive branch of the Government on the subjects of the excess war-profits tax and the fixation of the price of silver.

Advisory Council of Scientific and Industrial Research of Canada has appointed a subcommittee on chemistry, including the following members: Dr. R. F. Ruttan, McGill University; Prof J. W. Bain, University of Toronto; Dr. John Bates, superintendent Forest Products Laboratory of Canada, Montreal; Dr. F. J. Berchard, Dominion Grain Laboratory, Winnipeg; Prof. Adam Cameron, University of New Brunswick; Dr. W. H. Ellis, Dean of the Faculty of Applied Science, Toronto University; Dr. W. L. Goodwin, director School of Mines, Kingston; Dr. Milton L. Hersey, Montreal; Dr. F. M. G. Johnson, Dragon, Que.; Prof. A. F. L. Lehmann, University of Alberta; Dr. E. A. Lesueur, Ottawa; Prof. E. Mackay, Dalhousie University; L. C. Mackie, chief chemist Dominion Steel Corporation; Prof. D. McIntosh, University of British Columbia; Prof. R. D. McLaurin, University of Saskatchewan; H. W. Mathewson, Shawinigan, Que.; Prof. M. A. Parker, University of Manitoba; T. H. Wardleworth, Montreal.

Arizona Chapter, American Mining Congress, was organized as follows for the year 1917-18 at the annual meeting at Phoenix, Ariz., on Dec. 3-4: Officers: Joseph P. Hodgson, Bisbee, governor; L. S. Cates, Ray, first vice president; Robert E. Tally, Jerome, second vice president; Norman Carmichael, Clifton, third vice-president; Joseph E. Curry, Bisbee, secretary; H. J. McClung, Phoenix, treasurer. Directors: J. P. Hodgson, Bisbee; B. Britton Gottsberger, Miami; W. B. Gohring, Warren; George Kingdon, Jerome; J. C. Goodwin, Tempe; Norman Carmichael, Clifton; L. S. Cates, Ray; G. H. Dowell, Douglas; Robert E. Tally, Jerome; J. A. Burgess, Oatman; J. Kruttschnitt, Jr., Tucson; G. M. Colvocoresses, Humboldt; W. C. Browning, Superior; and W. G. McBride, Globe. The meeting appointed the following committee to acquire data on present costs of production, and on the number of leasing and other small operations that will be forced to cease in the event of reduction in copper price: Norman Carmichael, Clifton-Morenci; G. M. Colvocoresses, Humboldt; J. Kruttschnitt, Jr., Tucson-Hayden; W. C. Browning, Superior; Joseph E. Curry and G. H. Dowell, Bisbee-Douglas; R. R. Boyd, Globe; L. O. Howard, Miami; Robert E. Tally, Jerome.

Industrial News

Wellman-Seaver-Morgan Co., Cleveland, has taken an order from the Chile Copper Co. for a 12-ton ore bridge for use in connection with leaching vats.

Sullivan Machinery Co. announces that its Salt Lake City office has been moved to the Walker Bank Bldg., Room 1606. Burt B. Brewster is manager of the office.

Sullivan Machinery Co. has appointed Joseph H. Brown, hitherto assistant manager of its New York office, to be district sales manager at Chicago to succeed William P. J. Dinsmoor, who has resigned to engage in business in Denver, Colorado.

Hardinge Conical Mill Co. has received an order from the Homestake Gold Mining Co., of South Dakota, for an 8-ft. conical ball mill to work in competition and conjunction with the stamps of that company, which now has over 1000 stamps in daily operation. The Hardinge company believes that this mill, occupying the space of 10 stamps, will do the work of between 80 and 100 stamps.

Walworth Manufacturing Co., of Boston, Mass., makers of iron pipe fittings, valves, etc., announces that J. C. Bannister has been made a vice president of the company. Mr. Bannister has been connected with the manufacture of product for 26 years, starting with the Haxtun Steam Heater Co., at Kewanee, Ill., where he rose to be chief engineer. He was superintendent of the Kewanee Boiler Co. when the National Tube Co. took over the Western Tube Co. at Kewanee and was made manager of the plant, which was purchased by the Walworth Manufacturing Co. in August, 1917. Mr. Bannister will continue as manager of the plant at Kewanee.

New Patents

United States patent specifications listed below may be obtained from "The Engineering and Mining Journal" at 25c. each. British patents are supplied at 40c. each.

Aluminum—Process for Producing Aluminum Compounds. Frank Langford, Eureka, Calif. (U. S. No. 1,249,125; Dec. 4, 1917.)

Concentrators, Attachment for. Francis R. Hardie, Salt Lake City, Utah. (U. S. No. 1,249,078; Dec. 4, 1917.)

Conveyor. Fred Reed and Sam L. Inge, Bisbee, Ariz. (U. S. No. 1,248,714; Dec. 4, 1917.)

Dump Car. Herbert R. Keithley, Michigan City, Ind. (U. S. No. 1,248,666; Dec. 4, 1917.)

Dust Collector for Drills. Clayton F. Greene, Lead City, S. D., assignor of one-half to John Sandhoff, Lead City, S. D. (U. S. No. 1,249,070; Dec. 4, 1917.)

Fluid-Operated Drill. Louis W. Greve, Cleveland, Ohio, assignor by mesne assignments to the Cleveland Rock Drill Co. (U. S. No. 1,248,481; Dec. 4, 1917.)

Grab Bucket. William H. Botten, Cleveland, Ohio, assignor to the Owen Bucket Co., Cleveland, Ohio. (U. S. No. 1,248,605; Dec. 4, 1917.)

Hoisting and Conveying Apparatus. Walter Zetzman, Cornelius, Ore. (U. S. No. 1,248,980; Dec. 4, 1917.)

Hoisting and Dumping Apparatus. Charles E. Bathrick, Chicago, Ill., assignor to Frederick C. Austin, Chicago, Ill. (U. S. No. 1,248,600; Dec. 4, 1917.)

Metal Alloy Containing Gold, Silver and Osmium. Hugh S. Cooper, Cleveland, Ohio, assignor to the Electro Metals Products Co., Cleveland, Ohio. (U. S. No. 1,248,621; Dec. 4, 1917.)

Mine Cars, Keeper For. Albert William Spaht and George R. Jacobs, Christopher, Ill. (U. S. No. 1,249,231; Dec. 4, 1917.)

Oil Wells, Method of Shooting. James E. McAvoy, Foxburg, Penn. (U. S. No. 1,248,689; Dec. 4, 1917.)

Refractory and Process of Making Same. James O. Handy and Robert M. Isham, Pittsburgh, Penn., assignors, by mesne assignments, to Allen S. Davison Co., Pittsburgh, Penn. (U. S. No. 1,248,486; Dec. 4, 1917.)

Spelter, Process for Producing. Charles H. Fulton, St. Louis, Mo., assignor by mesne assignments, to Metallurgical Laboratories, Incorporated, Chicago, Ill. (U. S. No. 1,249,061; Dec. 4, 1917.)

Segregating Minerals, Method of and Apparatus For. Hiram E. Taylor, North Adams, Mass., assignor to National Metals Co., Phoenix, Ariz. (U. S. No. 1,248,948; Dec. 4, 1917.)

Steel—Apparatus for Heat Treatment of Steel. Thomas J. Fay, Brooklyn, N. Y., assignor by mesne assignments, to the Standard Parts Co., Cleveland, Ohio. (U. S. No. 1,249,056; Dec. 4, 1917.)

Steel—Process of Producng Steel in Side-Blown Converters. John H. Hall, New York, N. Y., assignor to Taylor Wharton Iron and Steel Co., High Bridge, N. J. (U. S. No. 1,249,075; Dec. 4, 1917.)

White-Metal Alloy. Henry K. Sandell, Chicago, Ill., assignor to Herbert S. Mills, Chicago, Ill. (U. S. No. 1,248,925; Dec. 4, 1917.)

Editorial Correspondence

SAN FRANCISCO—Dec. 15

Embargo on Gold-Mine Supplies as has been proposed caused some uneasiness in California and Nevada mining districts until the receipt of a telegram from Senator Newlands to the Nevada Mine Operators' Association and another from Albert Burch, of San Francisco, now in Washington, on behalf of the interests of the California Metal Producers' Association. Senator Newlands wire stated that the Priority Board assures him that nothing of the kind is now contemplated. Mr. Burch's dispatch stated that he was informed the rumor was without foundation. Whatever may have been intended or abandoned by the Priority Board respecting such an embargo is of less interest just now than the fact that immediately the statement or rumor was circulated in the Pacific Coast mining regions, the Nevada and the California mining men's associations got busy and were prepared to enter strong protests against any contemplated infringement on the rights of gold miners to protect their properties by continuous operation. Gold miners are not making great profits. The purchasing power of the gold they produce is prohibitive and about all the most of them can do is to keep the propertes operating, and that only by the practice of the strictest economy. Gold may not be just now an actual and active essential in the conduct of the war, but no one would be so foolish as to deny the ultimate necessity for both gold and silver. And no one in the smallest way acquainted with the operaton of gold mines will dispute the present necessity for conserving gold-mining property. An embargo on gold mines would mean the closing down of most of the properties in California and Nevada. Such an embargo would include such mines as the North Star, Empire, Brunswick and others in Nevada County and the Plymouth, Kennedy, Argonaut, Melones and others in the Mother Lode region and the Comstocks and the Goldfield Consolidated and other such properties in Nevada. Within the last five years, gold mining in these states has advanced through the adopton of improved metallurgical methods. Many old producers have been reopened and again placed in the producing class and new properties have been made productive by the application of modern methods of treatment of the ores. An embargo on gold mine supplies and commodities consumed by the labor employed would mean disaster that in many camps would amount to a calamity. Should the Priority Board at any time contemplate such embargo the mining men of the West will be ready with a protest that no intelligent body of men could ignore under the present conditions.

BUTTE—Dec. 15

Safety-First Campaign of the mining companies was advertised in large and highly interesting illustrated pages of the daily papers recently. The Anaconda Copper Mining Co., the Butte & Superior Mining Co,. the East Butte Co. and the Butte Street Railway Co. made a praiseworthy attempt to bring home to the general public the duty of protecting life and limb. Attention was called to the right way and wrong way of doing things and requesting coöperation between operating companies, workmen and the general public to bring about a decrease in avoidable accidents.

Coal Reduction of 50c. per Ton on one-ton lots and a saving of 75c. per ton on two-ton lots to the consumer has been made by the fixing of prices effective Dec. 10, by the County Fuel Committee in Silver Bow County. This was contrary to all expectations and was done over the protest of the retail dealers. Failing to have these prices modified by the local committees, the retail dealers have appealed to higher authority and have been promised a hearing before W. E. Dick, an examiner of the Federal Trade Commission, now in Montana. Whether the results will mean a return to the old prices or not is to be seen.

Decision Affecting Taxation of Minerals was handed down on Dec. 11 by the Supreme Court of Montana, denying the petition of the state for a hearing of the case of the Northern Pacific Ry. vs. Musselshell County, involving the taxation of coal reservations. Referring to the taxation of mines, after referring to net proceeds and improvements, the court holds that: "Mines are to be taxed upon their surface, (a) if bought from the United States, at the price paid therefore, unless (b) such surface is used and has a value for other than mining purposes, in which event they are taxable at such value; or (c) if not bought from the United States, then at the value of such surface consideration as real estate without reference to such mineral content below the surface."

DENVER—Dec. 15

Fluorspar Deposits in Colorado have received considerable attention during the last year. Many deposits of this mineral have been investigated and several properties are in active operation. In the Jamestown district, in Boulder County, the Emmett, Invincible, Harlow, Rattler and Terry properties have been the principal producers. Prices have ranged from $6.50 to $8.50 a ton. In the San Juan district, the Barstow mine, near Red Mountain, has been converted practically into a fluorspar mine, a 9-ft. vein of this material of good quality having been opened.

Gold Mining may be declared a nonessential industry by the Government. This possibility is giving the mining men of Colorado much concern, because shutting down the gold mines of the state will throw about 4000 men out of work, at least temporarily. The Cripple Creek district will be hard hit, although many of the gold-mining companies are operating at little profit on account of the great increase in the cost of supplies. If it is shown that the Government needs the cars, which are now being used for hauling ore and gold-mining supplies, for coal and war materials, then the mining men of the state will cheerfully coöperate with the Government in the interest of establishing necessary military efficiency.

WALLACE, IDAHO—Dec. 15

Idaho School of Mines at Moscow, will conduct a short course this winter with a view to preparing substitutes for the young professional and technical men filling positions as assayers, analyists and mine surveyors who have gone to the army. "We are receiving every day calls for men to fill such positions and do not know where to turn for a single man," says Dean F. A. Thompson. "Young men not yet of draft age or those who for various causes have been exempted will do well to consider the opportunities thus afforded. While of course the training must of necessity be largely of an empirical kind, we feel that this is a time for emergency courses and for the brushing aside, if need be, of academic precedents."

Value of Hercules Mine in October, 1916, was one of the essential questions in the trial being heard by Judge Deitrich, in the Federal court at Coeur d'Alene, which is nearing a close. Also, was Mrs. Mathilde Cardoner, who sold her one-sixteenth interest to Eugene R. Day and Mrs. Eleanor Day Boyce for $312,000, being on a basis of $5,000,000 for the property, induced to sell by false representation? Although the mine had paid in round figures $10,000,000 in dividends up to the date of the sale, beginning in 1901, from ore taken from above No. 5 tunnel, and although the oreshoot had been found practically the same at a depth of 500 ft. below this level and that it was reasonably certain, based upon the development of similar veins in nearby mines, that it would be profitably mined to a depth of 1800 ft. below No. 5, Eugene R. Day contended on the witness stand that he paid a high price. He referred to his purchase of the Samuels and Reeves interests many years ago on a valuation of $4,000,000 for the mine, and advanced the further reason for this opinion that there is a steady increase of iron in the ore with depth and a decrease in silver. He denied that he had withheld any information from Mrs. Cardoner, or that he had any design to get the interest until it was offered to him by Allen, and that he finally paid the excessive price to prevent the interest falling into the hands of outsiders and to secure control for the Day family. L. W. Hutton, who is one of the Hercules owners, said he told Mrs. Cardoner about the time she made the sale that $4,000,000 was a good price for the mine, "everything considered." He said he expected the ore to run out or be unprofitable at a depth of from 500 to 700 ft., and that he had the word of the foreman that it would last only seven or eight months. Frederick Burbidge, mining engineer and general manager of the Federal company, testified as a valuation expert for the Days. He had made a personal examination of the mine 10 days ago, which, in connection with the company records, was the basis of his conclusion that at the time of the purchase of the Cardoner interest the value of the mine was $6,454,423 and that it would take 9.4 years to get that value out of it. He also stated that the investments of the Hercules in the Northport smeltery and the Pittsburgh refinery should be deducted as they would be of no value after the mine was worked out. W. Earl Greenough, mining engineer, as valuation expert for Mrs. Cardoner, estimated the value of the ore in the Hercules in October, 1916, as $10,750,000, not including ore in transit and cash on hand. He stated that the average price of lead for the period from 1906 to 1915, inclusive, was $4.55 per 100 lb., and for silver, 56c. per oz., giving the "Engineering and Mining Journal" as authority for these figures. In giving his estimate of the value of the ore in the mine he figured lead at $4.50 per 100 lb. and that the mine would be profitably worked at a depth of 1600 ft. below No. 5. Harry L. Day and Jerome J. Day denied that they had anything to do with the deal; that they regarded the price paid Mrs. Cardoner as too high, and that they hesitated about taking a fourth interest subsequently at that figure. Attorneys for Mrs. Cardoner introduced an extract from the 1913 report of State Mine Inspector Robert N. Bell, in which he referred to the permanent character of the ore veins in the section in which the Hercules is situated, and described the Hercules oreshoot, 200 ft. below No. 4 tunnel, as better than ever and the longest oreshoot known in the Cœur d'Alene district.

CALUMET, MICH.—Dec. 13

Flint Blocks for Calumet & Hecla will be obtained from southern Tennessee for lining the Hardinge conical mills. Some time after the war broke out, the supply of Belgian quarried flint blocks having begun to run low, E. T. Lull, of Winona, Mich., who had formerly lived in Tennessee returned there to develop iron properties, and ran across a series of the Mississippian period, 200 ft. thick of interbedded flints, shales and limestones, the strata of the first running from 1 in. to 50 ft. in thickness. Learning that the Calumet & Hecla was looking for a supply of flint blocks in this country, he obtained options and had some blocks quarried and C. H. Benedict, metallurgist of the Calumet & Hecla, gave them a thorough trial, finding them satisfactory. The company then sent their geologist, C. D. Hohl, to Tennessee to ascertain the extent and prevailing quality of the beds, and as his report was favorable, the company ordered a supply and have been using these blocks ever since. The blocks in some minor respects are not considered so good as the Belgian, but they do the work required of them, and it is likely that improvements will be made in their selection and in the manner of getting them out so that they will closely approach the highest standards. The American Flint Co., the producing company, has its headquarters at Iron City, Tenn., which is situated a few miles north of the Alabama border.

MARQUETTE, MICH.—Dec. 13

Navigation Will Be Kept Open between upper and lower lakes as late as possible this winter. Coast guards are ordered to remain at their stations until Jan. 1 and the light houses will operate until that date. The explanation is contained in the following telegram from the general operating committee of the Railroads War Board to the vessel owners on the Great Lakes: "In view of the relief which water transportation on the Great Lakes affords to the congested railroads in the Eastern territory, your coöperation is solicited in an effort to extend the season of navigation as long as possible." On Dec. 8 the Government requisitioned the car ferry "Sault Ste. Marie," of the Duluth, South Shore & Atlantic Ry., at the Straits of Mackinac, and sent her to the channel below the locks to act as ice breaker through Hay Lake and Mud Lake. With

this assistance vessels can continue long beyond the usual closing of navigation if temperatures below normal do not occur. Blizzards and "below zero" weather on Lake Superior, Dec. 8 to Dec. 10, checked the ore movement, the carloads freezing solid when delayed, but the movement of coal to the head of the Lakes and grain to Lake Erie continues. [Later dispatches of Dec. 15 announced the closing of navigation at midnight.—Editor.]

Marquette Range Shipments of iron ore by way of the port of Marquette for the season of 1917, total 3,213,022 tons, as compared with 3,858,092 tons in 1916, a decrease of 645,070 tons. The decrease is due largely to the delay in opening navigation; an ice blockade held in place by a 40-day north wind prevented the free dispatch of ore carriers until six weeks after the usual date of opening of navigation. Slow dispatch at Lake Erie ports and scarcity of boats is slightly blamable for the reduced tonnage. At the Lake Superior & Ishpeming dock, Presque Isle Harbor, the "Peter White" cleared May 18, but with six other boats was ice bound off this port for days. The first boat to clear at the Duluth, South Shore & Atlantic docks, Marquette Harbor, was the "W. L. Brown," May 29, and this was the only boat cleared before July 1. Due to the ice, free dispatch of boats was impossible before June 15. Because of summer weather conditions in November, the Lake Superior & Ishpeming dock broke its November record with 256,048 tons, 30% in excess of 1916 November shipments. Practically all docks on Lake Superior broke their November record. The ore-shipping season at Marquette closed Dec. 10, although navigation of Lake Superior remains open. Presque Isle Harbor sent its last boat out Nov. 30 and Marquette Harbor its last, Dec. 10. Shipments from the port of Marquette for 1917 follow, with the 1916 tonnages in parentheses: From the L. S. & I. dock, Presque Isle Harbor, Cleveland Cliffs Iron Co., at Republic, 167,157 tons (201,656 tons in 1916); North Lake, 157,997 (266,464); Ishpeming and Negaunee, 1,576,748 (1,447,508); Gwinn, 482,935 (500,621); Regent Iron Co., Negaunee, tonnage unreported; Lake Superior Iron Co., Ishpeming, 61,690 (111,052); E. N. Breitung & Co., Negaunee, 42,242 (41,144); Jones & Laughlin Ore Co., Negaunee, tonnage unreported; total Presque Isle Harbor tonnage was 2,488,766, compared with 2,912,702 tons in 1916; 338 boats were loaded with average cargo of 7363 tons; from Duluth, South Shore & Atlantic Dock, Marquette Harbor, shipments amounted to 724,256 tons in 1917, comparing with 945,390 tons in 1916. Shippers were: E. N. Breitung & Co., Negaunee; Oliver Iron Mining Co., Ishpeming and Negaunee; American-Boston, Diorite; Republic Iron and Steel Co., Negaunee and Richmond Iron Co., Negaunee. The average cargo of 139 boats loaded was 5210 tons.

ISHPEMING, MICH.—Dec. 14

Stocking Ore commenced with the close of Lake shipping and conditions are favorable for a large winter production as stockpiles have been generally cleaned up. While all-rail shipments of considerable magnitude will be a winter innovation on the Menominee range, the Marquette range will not ship all-rail other than the usual shipments to supply the furnaces in this region. Extremely favorable weather made possible a strenuous finish to a season marked by delayed dispatch.

Removal of State Constabulary from Negaunee is protested by the mayor, the marshall and mining officials as it is felt that the presence of the mounted troop and the activity of it's officers in suppressing trouble makers has had a salutatory effect on the peace of the region. Being centrally quartered at the old Jackson Mine office, the troop is able to quickly reach any point near the center of the upper peninsula and their ability to suppress incipient trouble has frightened agitators from the district. The troop furnished valuable service to the Government in rounding up slackers and objectors in Gogebic County, having made important arrests on the Marquette Range and their presence is a valuable influence for order in this section. The recent inspection of the troop by Col. R. C. Vandercock and Major Phillips was quite commendatory of the discipline maintained by Captain Marsh.

DULUTH, MINN—Dec. 14

Ore Shipments from Duluth Docks were closed at the head of the Lakes on Dec. 11. All the docks with the exception of the Great Northern and the Northern Pacific have fallen short of last year's shipments which were record outputs. Following are the actual figures of the season with the tonnage for 1916 in parentheses: Duluth, Missabe & Northern, 20,567,420 tons in 1917 (21,837,849 tons in 1916); Great Northern, 11,550,917 tons (11,091,019 tons); Duluth & Iron Range, 9,990,900 tons (10,735,825); Northern Pacific, 695,021 tons (417,012); other additional shipments amounted to 1,712,965 tons; total for 1917, 44,517,221 tons comparing with 45,360,760 tons during the preceding year.

JOPLIN, MO.—Dec. 15

American Metal Co. has taken over the tract of 3500 acres, near Baxter, Kan., obtained some months ago by the Miami Zinc Syndicate, supposedly a subsidiary of the Butte & Superior Co., or at least including a number of its heaviest stockholders. The American Metal Co. has been operating in this district for some time under the name of the Chanute Spelter Co., also having an office in Joplin under the name of the American Metal Co. It has numerous leases north and northwest of Baxter already, and has been making good strikes on some of them, particularly those near Crestline, Kan. The acreage involved in the latest addition to the company's holdings was obtained for the Butte & Superior interests some months ago by Victor Rakowsky, of Joplin. The deal for the transfer to the American Metal Co. is known to have been under way for several weeks.

Relief From Car Shortage must be obtained immediately or otherwise this district is going to suffer considerable hardship and complications. Many of the mines have so much sold ore in their bins that they cannot continue operation without dumping the ore on the ground or building new bins. They also find it difficult to operate on account of financial reasons, as they are unable to collect in full for ore that the smelters have bought but cannot get delivered. Smelters also are running short of ore, and it is becoming so acute that some of them are threatened with enforced shutdowns unless more cars become avalable. It is estimated that at least 100 cars per week more than are now being received are needed for the district, and this would not give full relief. The heavy snow on Dec. 7, the heaviest the district has experienced in five years, has added to the troubles of the operators.

TORONTO—Dec. 17

Exploration of Manitoba Mineral Areas is being agitated by the Canadian Geological Survey for the base-metal ores now so much in demand in connection with the war. Hitherto prospecting in this province has been almost entirely confined to the search for gold, the prospectors as a class being unfamiliar with the appearance of other ores. In order to encourage exploration for other valuable minerals the Winnipeg "Free Press," acting in conjunction with the Geological Survey, which has furnished most of the specimens, has placed on view a large collection of minerals for the benefit of prospectors, including molybdenite, magnesite, chalcopyrite, hematite, corundum, chromite, galena, mispickle, etc. Dr. R. C. Wallace, professor of mineralogy in the University of Manitoba, in a recent lecture to the Winnipeg Geological Club, made an important proposition to the effect that such of the returned soldiers as preferred open-air vocations and the strenuous life to indoor callings should be trained as prospectors. He suggested that the work of training should be taken up by the universities with government assistance and employment assured to those found fitted. As the question of finding employment for returned soldiers is one of increasing urgency, the proposal is likely to find favorable consideration.

The Mining News

ARKANSAS

Boone County

GROUND HOG (Buffalo)—Machinery arriving for new 100-ton concentrating plant.

BEULAH (Rush)—Operated by Continental Mining Co.; will start work in new shaft soon. Rebuilding of mill to be completed shortly.

Marion County

POLK-KENDALL (Zinc)—Opening deposit of free and milling ore. Milling grade being cleaned at Jackson Mining Co.'s mill.

BROWN LEASE (Zinc)—Operated by L. L. Brown, in Coon Hollow; opening deposit of silicate. Wamath & Love, operating on old Miller land, also in body of free silicate.

ARIZONA

Mohave County

OATMAN SOUTHERN (Oatman)—S. R. Porter, superintendent, reports shaft reached vein. Sinking will be continued for 200 ft.

GOLD ORE (Goldroad) — Transformer station and electrical equipment completed. Sinking to be much faster; shaft to be sunk to 730-ft. depth.

Pima County

MAGNATE (Tucson)—Fourth drill hole entered sulphides at 90-ft. depth. Road being constructed to new shaft site; grading being done for power plant.

Pinal County

ASH SPRINGS (Kelvin) — Harp and Odell sold molybdenum property to Tucson men.

TROY ARIZONA (Kelvin) — Shaft reached 500-ft. point; station cut; crosscutting will start at once.

SILVER DIP (Ray)—Being worked under lease. Ores running high in lead and silver from lower crosscut tunnel.

CALIFORNIA

NAVAL FUEL RESERVE LANDS of California will be excluded from the provisions of the Oil Lands Leasing Bill, according to an amendment accepted by the Senate as a committee of the whole on Dec. 18. A vote on the bill was deferred until Jan. 7. This action makes certain the passage of the bill, which will throw open unlimited fuel resources to the public.

Amador County

ORIGINAL AMADOR (Amador City) —Samuel Spaich killed Dec. 7 by rock fall.

Calaveras County

EASZY BIRD (Mokelumne Hill)—Shaft down 200 ft. in vein matter carrying payable ore; ball mill operating regularly; 30 men employed.

FISHER (Mokelumne Hill) — Gasoline hoist being installed to be supplanted later by electricity. Shaft down 120 ft.; three 8-hr. shifts employed.

GWIN MINING CO. (San Francisco)—Reported sold traction engine and 10 ore cars to sugar plantation in Mexico. Situated near border of Amador County between Mokelumne Hill and Paloma. Formerly large producer, but idle for years and under water.

CALAVERAS COPPER CO. (Copperopolis)—Being opened to greater depth; maintaining largest output in history. Flotation satisfactory and increase in capacity contemplated. Payable ore recently developed.

Inyo County

CERRO GORDO (Keeler) — Shipping zinc-silver-lead ore. New territory being developed shows high-grade ore; also high-grade ore coming from main workings. In lower level, orebody showing improvement.

Kern County

RANDSBURG-ATOLIA (Randsburg) — Patrick Byrne killed Nov. 10 by fall of rock from bucket in shaft.

Los Angeles County

WESTERN CHEMICAL CO. (Long Beach)—Alex M. Schwitalla, secretary, Wilfred Schwitalla and William Rittle, a watchman, arrested and held pending investigation of cause of fire Dec. 1, which destroyed building, resulting in damages of $15,000. Company manufactures strontium nitrates for trench torches. This fire was culmination of series of small fires and explosions for last two years.

Nevada County

BLACK BEAR MINING CO. (Grass Valley)—Permit for issue and sale of stock revoked by commissioner of corporations.

Plumas County

NOBLE ELECTRIC STEEL CO. (San Francisco)—Shipping several cars of manganese ore from Crescent Mills weekly to electric smeltery at Heroult in Shasta County.

ARPS COPPER CO. (Copper City)—Making arrangements to sink main shaft 250 ft. deeper and increasing operating force. Shipping ore to Mammoth smeltery at Kennett.

ENGELS COPPER (Engelmine)—W. H. Hall killed Nov. 26 by breaking of restraining dam used to hold tailings. Slight damage done to machinery. Larger dam under construction below site of old dam.

Siskiyou County

GOLD ORE reported disclosed by prospectors on Jackass Creek near Sawyer's Bar. Vein shows free gold. Believed to be a source of enrichment of some of neighboring gravel mines.

HYDRAULIC MINERS in vicinity of Oak Bar prospecting high bedrock points in Klamath River. Christopher Jensen, of McKinney creek arranging for new high-line ditch, preparatory to piping new ground. H. J. Barton leased to Owen, Baldwin & McAllister, the Beaver Creek placer mine; open cut being driven to bedrock.

Tuolumne County

BUREAU OF MINES CAR NO. 1 at Jamestown giving instructions in first-aid work. Previously at Eagle-Shawmut mine. Will go to Oakland next.

COLORADO

Boulder County

LONGFELLOW (Jamestown) — Tunnel being driven to unwater this silver property.

GOLDEN AGE (Boulder)—Standard mill remodeled; aerial tramway repaired. Mine ore and dump will be treated.

CORKSCREW NO. 2 (Lakewood) — Tungsten property owned by Primos Chemical Co. being operated with profit by lessees.

SMUGGLER (Jamestown) — Being reopened. Part will be worked by company, and rest leased. Opened by 475-ft. shaft and extensive workings. Formerly a producer, but shut down on account of litigation. May build flotation plant to treat ore in dump, said to contain 75,000 tons.

Clear Creek County

ROBERTS (Georgetown) — Good-grade ore opened in development.

WALDORF (Georgetown)—Mill making better saving since installation of new tables. Concentrates and smelting-grade ore being shipped.

MOUNTAIN MINING AND MILLING CO. (Idaho Springs) — Leased by Denver men. Mine repaired and electric-driven compressor installed. Development to begin at once.

Gilpin County

HOMER (Central City)—Shipping gold-copper ore. Lateral development under way.

CASHIER MINING CO. (Central City)—Mill being constructed at Pittsburg mine. Meeker shaft being retimbered.

ANNEX (Central City) — Being reopened. Shaft retimbered, gasoline hoist installed, and drifting in good-grade gold-copper ore.

Gunnison County

VARIED MINERAL PRODUCTION of Pitkin district includes tungsten ore from Ida May, molybdenum ore from molybdenite mine and regular shipments of graphite-bearing rock from Ethiopian.

BON TON (Pitkin)—Eastern company has taken lease formerly held by I. L. Johnson. Boarding house being enlarged, office built, and supplies laid in for winter development.

Lake County

DUNKIN (Leadville) — This Fryer Hill property leased by Leadville men. Surface plant installed; new shaft will be sunk.

MATCHLESS NO. 2 (Leadville)—Leasing company secured block 100 ft. square, installed steam hoist, and started retimbering shaft. Shaft will be sunk to sulphide zone, estimated 100 ft. deeper.

MATCHLESS (Leadville) — Being reopened by Denver leasing company. Shaft retimbered to 250-ft. depth and several old drifts reopened, exposing zinc carbonate ore. Diamond drilling indicated large shoot good-grade silver ore. Surface plant installed; shaft sinking will be done later.

La Plata County

COLUMBUS (Durango) — Development opened vein showing high-grade ore.

San Miguel County

TELLURIDE CONCENTRATES SHIPMENTS for November; Liberty Bell, 21 cars to Durango; Smuggler-Union and Black Bear, 22 cars to Pueblo and 32 to Durango; Tomboy, 17 cars to Pueblo and 38 to Durango; Carruthers, two cars; total 132 cars. This compares with 116 cars for November, 1916.

Summit County

EXCELSIOR (Frisco) — Remodeled mill running satisfactorily.

HORN (Breckenridge)—Reopening property. Formerly silver producer.

MUTUAL COÖPERATIVE (Kokomo)—Development on new vein in lower tunnel level satisfactory. Shipping from old workings.

KING SOLOMON (Frisco)—Main tunnel, in one mile, will be driven to cut No. 12 vein. Development on No. 11 vein opened shipping-grade ore.

Teller County

GOLD DOLLAR (Cripple Creek) — Osberg lease shipping 15 cars per month of good-grade ore.

GOLD SOVEREIGN (Cripple Creek) — Operated by Hahnewald Leasing Co. Development satisfactory on 1450-ft. level.

DANTE (Cripple Creek)—Milling-grade ore developed by Big Toad Mining and Milling Co., of Denver.

CATHERINE MINING CO. (Cripple Creek)—New electric plant installed; operations started.

DRAPER AND SADIE BELL (Cripple Creek)—Operated by lessees through 15th level of Jackson shaft of Gold Sovereign company.

CRIPPLE CREEK DEEP LEASING CO. (Cripple Creek)—Working on Jerry Johnson mine; shipped eight cars ore to Golden Cycle mill in October.

CAMP BIRD (Cripple Creek)—Operating Rose Nicol mine; sinking shaft from 800- to 1000-ft. level. Stopped operating through Portland No. 2 shaft.

UNITY MINING AND LEASING CO. (Cripple Creek)—Leasing company operating on one-half Nightingale claim lying on Raven Hill. Shaft 400 ft. deep will be sunk to 800-ft. level. Claim adjoins Maggie claim of Cresson.

MODOC CONSOLIDATED (Cripple Creek)—Station at 1100-ft. level of Frankenberg shaft on Ocean View claim completed; developing laterally. Raising from old incline shaft. Ground adjacent to Modoc incline shaft will be leased.

IDAHO

Shoshone County

MARSH (Burke)—Running 200-ton mill full time this month on accumulation of ore. Formerly ran only one-third of each month, the Hecla company using it two-thirds to treat zinc-lead ore.

EAST CALEDONIA (Wardner)—Shaft extended 200 ft. from 400-ft. to 600-ft. level; preparing to crosscut vein for 150 ft. Improvement of ore found in upper levels and commercial ore expected on 600-ft. level. Shaft is two-compartment one and sunk 200 ft. at rate of 100 ft. per month, with total payroll of 12 men. Believed to be record in district for development of this class.

MORNING (Mullan)—Closed down to make necessary repairs in shaft. Shaft is 1200 ft. below main working tunnel. Part in swelling ground caused trouble. Will make permanent repairs by easing ground pressure and reinforcing shaft with heavy timbers, requiring from 30 to 60 days. Employing 600 men, about half of whom have been laid off. Repairs and additions to mill and building of modern dry and change house for miners will require large number of employees. Owned by Federal Mining and Smelting Co.

YUKON GOLD (Murray) — Dredge launched several weeks ago expected to be operating in about 10 days. Electric power line of the Washington Water Power Co., for transmission of power, completed. Company has secured all ground along Prichard Creek, for 14 miles; was prospected during last year and a half, and estimated will produce over $2,000,000. Reported company is negotiating for additional ground along Eagle Creek, a tributary of Prichard; also that company plans putting on two more dredges next year.

MICHIGAN

Copper

INDIANA (Lake Mine)—Both drifts on third level in 650 ft. showing no commercial ore; prospects good.

OSCEOLA (Osceola) — November rock production will be less than 10,000 tons owing to loss of men.

FEDERAL SYNDICATE (Calumet) — Diamond drilling stopped on property, 1½ miles southeast of Phoenix. Drill removed.

HANCOCK CONSOLIDATED (Hancock)—Production for November was 22,879 tons of rock, a falling off due to labor shortage.

NORTH LAKE (Lake Mine)—Northwest drift on eighth level in 1700 ft. showing no ore; southwest drift in 1600 ft. showing no copper since that found at 765 ft.; expect to cut both lodes shortly.

MICHIGAN (Rockland)—No immediate intention of suspending operations; shaft now down 120 ft.; intend cutting loading station. Development on seventh level satisfactory in drift and crosscut on Ogimah lode.

WHITE PINE (Ontonagon)—Continuing to open up ground in spite of high costs. Recovery of copper requires special concentrating conditions. Averages 27 lb. in the two sandstone formations with intervening slate. Diamond drilling to determine dip of beds beyond fault at 1140-ft. depth.

Iron

LAKE ANGELINE (Ishpeming)—Contract for stripping orebody in east end completed; 40,000 tons of ore loaded. Much of ore is under quicksand and mining is so difficult that other methods will be tried next season.

STEPHENSON (Gwinn)—Struck large flow of water of unknown source; since Dec. 4 in spite of all available pumps in district and two bailers, water reached to fifth level. Operations suspended, men being sent to other mines of company, where night shifts have been started to take care of extra men. Miners removed in safety but mechanic installing pipe lines killed while boarding cage through misunderstanding of signals.

MINNESOTA

Mesabi Range

BENNETT (Keewatin)—Stripping operations closed down for winter on account of intense cold. Butler Bros., operators.

PEARSON (Nashwauk)—Just been reopened and washing plant constructed. Will show small shipments for 1917 because of delay in starting. Operated by Shada Mining Co.

MONROE (Chisholm)—Shaft down 300 ft. to be sunk 100 ft. farther. Original shaft lined with monolithic concrete construction; new portion will have lining composed of concrete sets and laths made at company's concrete plant at Hibbing.

LA RUE (Nashwauk)—Ore washed at concentrator, in which districts' experimental work performed. Ore mined by steam shovel, dumped into hopper at pit bottom and elevated by conveyor belt to top of washing plant. Operated by M. A. Hanna Co.

YORK (Nashwauk)—Stripped last winter by large drag-line excavator; inclined shaft built from top of washing plant to carry ore trammed from mine and hoisted to washing plant. Latter is same as that in use at other mines with addition of Richards classifiers as final method of improvement.

MISSOURI

Joplin District

SINDEN (Picher, Okla.)—Will have 300-ton mill completed in about three weeks. Situated short distance south of Picher. Owned by Tulsa men who own Admiralty. W. B. Shackelford, manager.

ADMIRALTY ZINC (Douthat, Okla.)—Moving mill from Webb City to lease on Thomas land, three miles southwest of Baxter, Kan., where recent drilling showed ore, 180 ft. thick.

MERRILL (Joplin)—Taken over Inspiration plant, northwest of Blue Mound and will operate. Mill just completed, having been moved from Duenweg. Merrill company also started new mill northeast of Quapaw, Okla.

CORTEZ (Jefferson City)—Incorporated for $140,000; stock oversubscribed by Jefferson City residents; to build mill on lease near Picher, Okla. Two drills now busy blocking out mill site, and expect to have plant in operation in four months. G. E. Haigh, president.

ST. JOE (Picher, Okla.)—Sinking mill shaft to 265 ft., encountered rich ore-bearing water course; 4-in. pump sufficient so far. Averaged 11% recovery on all ore taken out since Oct. 1; previous to that time some ore was still richer. J. W. Grounds, Jr., Joplin, superintendent.

UNITED ZINC SMELTING CORPORATION (Joplin)—Purchased Metals Mining Co. mill, just north of Golden Rod Mining and Smelting property at Picher, Okla.; changing gas equipment to steam. Temporarily closed down Coronet mine, west of Baxter, after brief operation. Reported ground is too lean at present prices.

MONTANA

Madison County

IN VIRGINIA CITY DISTRICT, John Dullenty is resuming work on gold-lode property, at head of Alder Gulch.

METALLIC MINE, operated by William Thompson, in Barton Gulch, recently made shipment of carload of ore to Washoe smeltery, at Anaconda.

IN TWIN-BRIDGES DISTRICT the first motor truck for mining purposes was put in operation, Dec. 7, by Crystal Lake Gold Mining Co. to transport ores and supplies between Dry Georgia and Goodrich gulches and railroad at Twin Bridges.

Silver Bow County

ANACONDA (Butte)—On Dec. 10, output from Butte mines was 14,173 tons of copper and 251 tons of zinc ore. Number of men employed, 9979. Tonnage and operations in general are rapidly reaching normal.

NORTH BUTTE (Butte) — Thomas Slater, administrator of estate of John Slater, brought suit against company for $10,000 damages for loss of life of John Slater, in Granite Mountain shaft fire, on June 8 last.

NEVADA

Clark County

GILLICE & McCOY (Las Vegas)—Manganese ore recently discovered, 15 miles northeast of here. Being developed under bond and lease. Ore is wad, said to average over 40% manganese. Four beds exposed, the largest averages 10 ft. in thickness, as shown by churn drilling and proved over area of one acre. Have shipped several carloads. Bad roads hampering operations.

YELLOW PINE (Goodsprings)—Producing about 1200 tons zinc concentrates and 300 tons lead concentrates monthly. Orebody recently opened in north end reported to be largest yet encountered and averages 30% zinc, 18% lead and 12 oz. silver per ton. Crosscutting from 900-ft. level to reach possible extension within 60 days. New 400-cu.ft. Chicago Pneumatic Tool Co. compressor installed, also drilling equipment.

Nye County

TONOPAH ORE PRODUCTION for week ended Dec. 8 was 10,206 tons, valued at $178,605, comparing with 10,061 tons, the previous week. Producers were: Tonopah Belmont, 2767 tons; Tonopah Mining, 3050 tons; Tonopah Extension, 2380 tons; Jim Butler, 247 tons; West End, 1099 tons; MacNamara, 541 tons; Montana, 122 tons.

UNION AMALGAMATED (Manhattan)—Resuming development from bottom or 600-ft. incline level of Bath shaft. Earl shaft enlarged and completely retimbered to 222-ft. point. Compressor foundation finished and building nearly completed.

Washoe County

NIXON NEVADA (Copperfield)—Situated 14 miles northwest of Reno. Developing copper ore and results reported favorable. Crosscutting opened three of company's four known veins; copper, gold and silver.

NEW MEXICO

Grant County

GREEN KING (Lordsburg) — Closed down; machinery will be sold. Property proved unprofitable.

Luna County

GAGE MINING CO. (Gage)—Much activity at old Victoria mine; being operated by Louisiana men; over 150 employees at Gage camp.

OREGON

ABBOTT AND WILLIAMS (Selma)—Two stamp mill erected at this gold mine on Illinois river near Selma. Ore is gold.

OSGOOD PLACER (Waldo)—I. L. Thomson made second payment on this placer property, one mile south of Waldo. Preparing for development. Reported bed rock carries platinum.

COLLARD, MOORE AND COLLARD (Kerby)—This chrome mine near Kerby making concentrates. Concentrator erected last spring. Shipped over 2500 tons and considerable tonnage in sight.

SOUTH DAKOTA

Lawrence County

GOLDEN REWARD (Deadwood)—Gilt Edge Mine, in Galena District, being prospected; oxidized ore will be shipped to company plant.

MONTEZUMA AND WHIZZERS (Deadwood)—Diamond drilling continues under direction of J. T. Milliken, who has bond on property and also purchased Oro Hondo after doing two years' development work.

Pennington County

BLUE LEAD (Hill City)—Being developed by new owners; one car copper ore shipped to smeltery.

GOLD KING (Rochford)—Headframe, shaft house, boilers, compressor and hoisting engine being installed to facilitate development.

UTAH

Juab County

CENTRAL HILL (Mammoth)—Drifting started at 385-ft. depth for vein found 100 ft. above.

EUREKA LILY (Eureka)—Blower being installed for better ventilation. Drifting on 1400-ft. level. Adjoins Tintic Standard.

LEHI-TINTIC (Eureka)—Recent strike in Empire vein at depth continues. Shipping and milling grade ore developed. Expected to begin shipments soon.

IRON BLOSSOM (Silver City)—Sinking No. 1 shaft to 2100-ft. level, where prospecting to be done on large scale. Good tonnage of low-grade ores being shipped to Tintic milling plant, and some ore of better grade also shipped.

DRAGON CONSOLIDATED (Silver City)—Continuing heavy shipments of fluxing ores as well as shipping some higher grade. Keeping up development. No. 1 shaft, down about 1500 ft., equivalent to about 2000 ft. in adjoining Iron Blossom.

CHIEF CONSOLIDATED (Eureka)—During quarter ended Sept. 30, large amount of development done, chiefly by drifts from 700-ft. level to 1800-ft. Work was in old ore channel with the exception of drifts on 1800- and 1600-ft. levels which opened new ore zone with good ore on both levels.

TINTIC DELAWARE (Eureka)—Group of 14 claims covering about 280 acres to be developed during winter. Equipment installed and road built. Auto truck and trailer purchased. Two cars of shipping ore on dump. Company recently organized to operate this property for 20 years worked on small scale by Ekker Bros., who retain an interest. W. D. Rawson, J. T. Hammond, Jr., and J. F. Rawson, interested.

Salt Lake County

BINGHAM MINES (Bingham)—Earnings for first 10 months of 1917, including both Bingham and Tintic properties were $747,500 as compared with $310,000 for 1916. October earnings were $28,000 as compared with $13,385 in September. Bingham properties—Dalton & Lark and Yosemite—earned $9000 in October as compared with $14,061 in September; Eagle & Blue Bell (Tintic) $7000, as compared with deficit of $3355 in September. Victoria (Tintic) estimated to have earned $12,000 during the month, an increase of $9346 over September.

Utah County

GLOBE (American Fork)—Working on surface strike to prospect further before winter prevents outside work; will then drive tunnel to get under outcrop; now in 100 ft., objective point about 500 ft. farther. Depth, 500 to 600 ft.

BELLEROPHON (American Fork)—Leasing company operating said to plan erection of mill to treat milling ore, of which said to be 10,000 to 12,000 tons blocked out. Ore carries silver, lead, gold and small amount of copper. Most of ore is milling grade. Sample of this character successfully run through Pacific mill.

WISCONSIN

Zinc-Lead District

UTT-THORNE (Platteville)—Purchased equipment of Wilson plant, at Potosi.

WISCONSIN ZINC CO. (Platteville)—Shipping from Skinner roaster, at New Diggings, over new spur, 1¾ miles long with 600 ft. of tunnel, connecting with C. & N. W. Ry.

VINEGAR HILL (Platteville)—Adding another Pomona power head pump at Jefferson mine, Hazel Green. Shaft sunk 45 ft. away from vein and water required only 700-gal. pump; since tapping main water flow installed 1000-gal. Pomona, 2000-gal. Prescott stationary pump, two vertical centrifugal sinking pumps of 500 and 800 gal. each and stationary centrifugal 500-gal. pump. Intend to solve water problem before extracting ore; mill equipment completed.

CANADA

British Columbia

CONSOLIDATED MINING AND SMELTING (Trail)—Closing of works by strike seriously affects Kootenay district and several properties in northern Washington. Plant closed several weeks ago when 1600 employees walked out, demanding an all-around eight-hour day, which would have affected only 350 men.

Ontario

ADANAC (Cobalt)—New oreshoot 2½ in. wide encountered on 400-ft. level.

KEORA (South Porcupine)—Two veins respectively 8 and 20 ft. wide encountered in diamond drilling.

KERR LAKE (Cobalt)—November production was 205,000 oz., a slight falling off from previous months.

SCHUMACHER (Schumacher) — New vein 5 ft. wide struck on 600-ft. level. Stated to carry about $10 ore.

GREEN MEEHAN (Cobalt)—Vein, 14-in. wide carrying high silver content stated to have been encountered in shaft at 140 ft.

BOURKE'S MINES (Bourke's Station)—Large camp buildings being erected preparatory to development during winter.

CANADIAN KIRKLAND (Kirkland Lake)—Shaft down 30 ft. on 15-ft. vein showing mineralization. Second shaft will be sunk on another vein.

GENESEE (Cobalt)—Crosscutting being done on 500-ft. level; number of small veins carrying cobalt and low silver content encountered.

GRAZELLE & HONER (Kirkland Lake)—Optioned to Temiskaming. Mining plant from North Dome, Porcupine, owned by Temiskaming, will be installed.

PARSON CLAIMS (Munro Township)—Acquired by Hill Gold Mining Co. Camp buildings put up and mining plant being installed. Shaft down 30 ft. on 18-in. quartz vein showing gold.

BURNSIDE (Kirkland Lake)—Aladdin-Cobalt acquired this property, preparing for development; will use electrically driven mining plant, installed one year ago on Sylvanite property.

TEMISKAMING (Cobalt) — Will offer shareholders half interest in a Kirkland Lake gold property, now under option to Beaver, at 40c. a share. Considerable opposition to deal, because no financial statement or report by independent engineer submitted. Ore reserves estimated at about $1,000,000 in value.

MEXICO

EXPORT TAX ON MINERALS, including iron ores, will be doubled after Jan. 1, 1918, according to statement of Rafael Nieto, under-secretary to the Mexican ministry of the Treasury. Also, the existing moratorium will be raised to the extent of providing for payment of interest on capital.

BOLIVIA

LLALLAGUA (Llallagua) — Produced during October, 20,500 quintals of 71.44% barrilla; shipped in October 19,710 quintals; stock on hand at end of October, 6293 quintals.

KOREA

SEOUL MINING CO. (Hol-Kol, Hwang-Hai)—By cable reported, milling operations on Suan concession recovered $121,335 for November.

ORIENTAL CONSOLIDATED (Unsan) October bullion amounted to $120,152, divided as follows: Tabowie mill, $32,052; Taracol, $22,010; Maibong, $14,146; Taracol cyanide plant, $50,032; Maibong tube mill, $1911. Milled in October, 26,174 tons. Still short of native labor but expect to have ample supply with advent of cold weather, as Koreans always return to mines then.

The Market Report

SILVER AND STERLING EXCHANGE

Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence	Dec.	Sterling Exchange	Silver New York, Cents	Silver London, Pence
13	4.7515	85⅛	42⅞	17	4.7515	85⅞	43
14	4.7515	86⅛	43⅜	18	4.7515	85⅞	43
15	4.7515	85⅞	43	19	4.7515	85⅛	43

New York quotations are as reported by Handy & Harman and are in cents per troy ounce of bar silver, 999 fine. London quotations are in pence per troy ounce of sterling silver, 925 fine.

DAILY PRICES OF METALS IN NEW YORK

Dec.	Copper Electrolytic	Tin Spot.	Lead N. Y.	Lead St. L.	Zinc St. L.
13	*23½	†88	6½ @6½ 6½	6.25 @6.30 6.25	7⅛ @7⅛ 7⅛
14	*23½	†88	6½ @6½ 6½	6.25 @6.30 6.25	7⅛ @7½ 7½
15	*23½	†88	6½ @6½ 6½	6.25 @6.30 6.25	7½ @7½ 7.35
17	*23½	†88	6½ @6½ 6½	6.25 @6.30 6.25	7.35 @7.45 7.35
18	*23½	†88	6½ @6½ 6½	6.25 @6.30	7.35 @7.40 7.35
19	*23½	†88	6½ @6⅝	6.25	@7.40

† Nominal.

* Price fixed by agreement between American copper producers and the U. S. Government, according to official statement for publication on Friday, September 21, 1917.

The above quotations (except as to copper, the price for which has been fixed by agreement between American copper producers and the U. S. Government, wherein there is no free market) are our appraisal of the average of the major markets based generally on sales as made and reported by producers and agencies, and represent to the best of our judgment the prevailing values of the metals for the deliveries constituting the major markets, reduced to basis of New York, cash, except where St. Louis is the normal basing point.

The quotations for electrolytic copper are for cakes, ingots and wirebars.

We quote electrolytic cathodes at 0.05 to 0.10c. below the price of wirebars, cakes and ingots.

Quotations for spelter are for ordinary Prime Western brands. We quote New York price at 17.5c. per 100 lb. above St. Louis.

Some current freight rates on metals per 100 lb. are: St. Louis-New York 17c.; St. Louis-Chicago, 6.3c.; St. Louis-Pittsburgh, 13.1 cents.

LONDON

Dec.	Copper Standard Spot	Copper Standard 3 Mos.	Copper Electrolytic	Tin Spot	Tin 3 Mos.	Lead Spot	Zinc Spot
13	110	110	125	300	295½	30½	54
14	110	110	125	299½	295½	30½	54
15							
17	110	110	125	304	297	30½	54
18	110	110	125	304½	297	30½	54
19	110	110	125	309	298½	30½	54

The above table gives the closing quotations on London Metal Exchange. All prices are in pounds sterling per ton of 2,240 lb. For convenience in comparison of London prices, in pounds sterling per 2,240 lb., with American prices in cents per pound the following approximate ratios are given, reckoning exchange at $4.7515. £30½ = 6.4696c.; £54 = 11.4545c.; £120 = 25.4544c.; £137 = 29.0605c.; £240 = 50.9089c. Variations, £1 = 0.2121205c.

Metal Markets

NEW YORK—Dec. 19

More business was done in copper this week than in anything else, lead and zinc being especially dull. The situation of tin was unchanged, but some people thought they could discern signs of amelioration.

Copper—The chief event of the week was the meeting of the copper producers in Washington on Dec. 14 at the invitation of the War Industries Board, which conducted a hearing having in view the terms on which the Government will buy copper after the end of January. Strong representations were made by the smaller producers, and by some of the larger producers, that the present price is not sufficiently high to develop the maximum production. The War Industries Board postponed further consideration of the matter. The general feeling among producers is that the present price for copper will at least be maintained, and that the price may possibly be raised to 25c.

Another important event of the week was the increase in business with consumers for copper to be delivered after January, this business having now attained proportions that is represented by round millions of pounds. There were increased transactions this week, including individual contracts of several millions of pounds each. This business was done for February-March delivery, at a flat price of 23½c., cash, New York, without guarantee.

Copper Sheets are quoted at 31½c. per lb., f.o.b. mill, for hot rolled, and 1c. higher for cold rolled. Copper wire is quoted at 26@27c., f.o.b. mill, carload lots.

Tin—We continue to quote this market nominally at 88c. That price would be paid, but no business was reported. There were indications of more permits being issued from London which would ease the situation later on.

Lead—Lead producers, including both refiners and representatives of the mining industries of the West, met the War Industries Board, by invitation, in Washington, on Dec. 17, to discuss the matter of fixing a maximum price for lead. After considerable discussion, it was decided by the War Industries Board not to fix any minimum price, but to let this market alone.

The lead market this week was very dull, transactions being smaller than during any week for a long time. There was, perhaps, a little more inquiry for lead to be delivered in January, but this did not express itself in business, although it may do so later. Owing to freight delays, lead on the spot in New York is fetching some premium, but this pertains only to relatively trifling business.

Zinc—This market was again very dull, and was a little weaker in tone. Toward the close, common spelter was easily obtainable at 7⅞c. Brass special was also a drug on the market, metal guaranteed not to run over 0.6% lead and 0.04% iron being offered at 7⅞c. in the early part of the week. High grade intermediate could be bought at 10@10⅛c.

Zinc Sheets—Price of zinc sheets has not been changed. Market is still at $19 per 100 lb. f.o.b. Peru, less 8% discount.

Other Metals

Aluminum—This market continues dull, though there is slightly greater inquiry. No. 1 ingots are offered at 36@37c. per lb., New York.

Antimony—Spot was a shade weaker. We quote 15c. We quote futures at 13¾@14¼c., c.i.f., in bond. There are fair stocks in the market but little demand, wherefore conditions of production in China do not at present affect the market seriously.

Bismuth—Unchanged at $3.50 per pound.

Cadmium—This metal is quoted at $1.50@1.75 per lb., depending on the quantity.

Nickel—Steady at 50c. per lb., premium of 5c. per lb. for electrolytic.

Quicksilver—The major market continues at $115, which we quote, though sales of small lots of spot were reported as high as $122@125. Spot stocks in this market were practically exhausted. San Francisco reports, by telegraph, $112.

Gold, Silver and Platinum

Gold—Gold coin in the Treasury on Dec. 1, 1917, was $3,040,472,040, comparing with $2,741,669,491 in 1916; held in Treasury as assets of Government against banknotes, $1,192,279,247, comparing with $255,669,836 in 1916; held by Federal Reserve Bank against note issues, $389,210,005; gold money in circulation, $1,065,170,819.

Silver—This market has remained very steady during the last week. Moderate amounts only of silver are going to London. The bulk of the bullion has been consigned this year to the East via San Francisco. Exportations from that port for the Calendar year 1917 so far have been about 25,000,000 ounces.

Mexican dollars at New York: Dec. 13, 66c.; 14, 67c.; 15, 67c.; 17, 67c.; 18, 67c.; 19, 67c.

Platinum—Unchanged at $103@105.

Palladium—Strong at $130.

Zinc and Lead Ore Markets

Joplin, Mo., Dec. 15—Blende, per ton, high, $71.80; basis 60% Zn, premium $70; medium to low, $60@50; calamine, per ton 40% Zn, $35@38. average selling price, all grades of zinc, $54.74 per ton.

Lead, high, $79.80; basis 80% Pb, $75@80; average selling price, all grades of lead, $73.69 per ton.

Shipments the fortnight: Blende, 10,438; calamine, 852; lead, 2469 tons; value, all ores the fortnight, $811,020.

Snow fell to a depth of 14 in. Friday of last week and, accompanied by zero weather, tied up electric interurban service and most of the mines three to four days. The severity is unprecedented at this season of the year. Many of the mines are only getting free from the deluge of snow; hauling was light during the last week, and for this reason the report is given for the fortnight.

Platteville, Wis., Dec. 13—Blende, basis 60% Zn, unchanged at $75 base for premium grade down to $57 base for second grade. Lead ore, basis 80% Pb, $75 per ton. Shipments reported for the week are 3470 tons of zinc ore, 192 tons of lead ore, and 332 tons of sulphur ore. For the year to date the figures are: 141,498 tons of zinc ore, 6881 tons of lead ore, and 27,337 tons of sulphur ore. Shipped during the week to separating plants, 3249 tons of zinc ore.

Other Ores

Manganese Ore—Metallurgical ore continued to be quoted at $1.20 per unit.

Molybdenum Ore—There was considerable demand and sales were made at $2.25@2.30 per lb. of molybdenum sulphide on the basis of 90%. There is reported to be a large inquiry in the market from a steel maker.

Pyrites—Spanish lump is now quoted at 15c. per unit, on basis of 10s. ocean freight, buyer to pay excess freight and war risk, except that concession of 2% of war risk is allowed. However, a small lot of Spanish lump ore was recently sold on a basis of 15½c. Ocean rates remain at 35s. for Northern, 40s. for Southern and 42s. 6d. for Gulf ports, but recent charters have exceeded these rates in several instances.

Prospect of Government red tape in distribution and allotment of Spanish pyrites is worrying importers.

Tungsten Ore—Considerable business was done in both wolframite and scheelite. We quote scheelite at $26 per unit. The quotation for wolframite is wholly a matter of grade. Ore of 65% grade, free from impurities, realized $25, while ore of 64% containing 3% S fetched $24. Other ores were sold at $22@24.

Charles Hardy, under date of Dec. 18, reports as follows:

"Wolframite according to quality ranged from $22@24 a unit and scheelite was again sold at $26. Of late, South America has shipped larger quantities of scheelite of an excellent quality, free from all impurities and the late arrivals have all been well above 70%. A premium has been paid for this grade of ore. At a meeting held yesterday by the American Iron and Steel Institute arrangement was entered into whereby tungsten will be subject to the same regulations as are now applying to tin and all consignments will in future have to be shipped to the order of the American Steel and Iron Institute, with modification to the importer. By so doing

the Government will have control of the imports and the importer will have facilities in getting his license granted so much quicker. The new arrangement covers not only tungsten, but practically all ores that are regularly imported from abroad into this country."

Iron Trade Review

NEW YORK—Dec. 19

The handicaps on pig iron and steel production have been increased in the last week by heavy snows in the East and Central West, causing fresh shortages in coal and coke. The week's steel output in the Youngstown district, says "Iron Age," has been only about half of the capacity; at Cleveland the American Steel & Wire Co.'s plants were closed down for nine days; in eastern Pennsylvania five furnaces were banked; 20 were banked early this week at Pittsburgh and in the two valleys; and throughout the country the coal situation of iron and steel works has been either worse or unimproved.

At Chicago the shortage of coal and coke is cutting down the production of some companies, while all are worried by the smallness of the margin of safety. Six blast furnaces of the Illinois Steel Co. are banked and one furnace and one mill of the Wisconsin Steel Co. are idle. One new South Chicago stack of the Mark Mfg. Co. will go in blast early in 1918.

Following the Federal Trade Commission's cost conference with iron and steel companies at Washington on Friday, at which the October increases in production cost were emphasized, the impression has gained strength that no important revision of existing price schedules will be made on Jan. 1. The steel manufacturers' committee met in New York, Dec. 19, and a meeting with the War Industries Board at Washington is expected to be held soon.

Work has stopped on Russian locomotives and many of those already built but not shipped may yet be converted for use at home. A large program of locomotives and car building for domestic roads, under Government auspices, is being worked out.

General export business is at a low ebb. Harassed by priority interference at mills, by the scarcity of ocean-vessel space, by delays and refusals of cars and by frequent changes in regulations, exports are under pressure from buyers abroad who try for the agreed price scales. The outlook until after the war or until Government demand is more accurately measurable is for thin picking in exports. One successful release of plates covers 1500 tons for France, done at 4.75c. A French railroad is willing to pay 5c. at mill for 300 tons.

The volume of structural steel business for shipbuilding and other Government needs is surprising in view of the almost total absence of private building work. The Bridge Builders' and Structural Society reports 138,500 tons of shop capacity put under contract in November, more than in any other month this year.

An example of the large tonnage called for at private works on Government account is 4000 tons just let for a new ordnance plant at Alliance, Ohio. Later building at the same place will require 3000 tons. The leading fabricator will be busy for most of next year on work already in hand, much of it for shipyards.

Sheet-bar and billet buying has quieted down, chiefly because so little steel can be had. Some sheet mills have been unable to contract for bars, but are taking what they can get from week to week.

Pig-iron consumers feel the situation tightening upon them. Central Western steel companies find it hard to get iron in the market to make up their shortages, but it is known that one of them recently closed for 22,000 tons of basic iron. Forge-iron sales of 15,000 to 20,000 tons are reported at Pittsburgh. In the East, where activity has been greatest, the week has been the quietest in a long time.

Pig-iron producers are now reporting each week to the Government, giving full data as to sales, production, destination of shipments and stock on hand. This serves to check up priority orders, which every week seem to be covering a larger proportion of the output.

All imports of ferroalloys or of their ores, by arrangement between the War Trade Board and importing interests, will be handled by the American Iron and Steel Institute. This was decided at a meeting in New York this week, the plan being identical with that now followed in the case of pig tin. Ferromanganese imports have dwindled to a small figure and at the same time domestic production has declined. There is a further complication from the proposal of the Government to commandeer vessels that have been depended on to bring Brazilian manganese ore to this country.

STOCK QUOTATIONS

N. Y. EXCH.†	Dec. 18
Alaska Gold M.	1⅛
Alaska Juneau	1⅛
Am.Sm.& Ref.,com.	69⅛
Am. Sm. & Ref., pf.	100⅛
Am. Sm. Sec., pf., A	90⅛
Am. Sm. Sec., pf. B.	‡96
Am. Zinc	11¼
Am. Zinc, pf.	40
Anaconda	55
Batopilas Min.	1⅛
Bethlehem Steel	68⅛
Bethlehem Steel, pf.	85
Butte & Superior	13⅝
Cerro de Pasco	25⅛
Chile Cop.	13⅛
Chino	37⅛
Colo. Fuel & Iron	31⅛
Crucible Steel	48⅛
Dome Mines	6⅛
Federal M. & S.	8⅛
Federal M. & S., pf.	28
Great Nor., ore ctf.	23⅛
Greene Cananea	35
Gulf States Steel	80
Homestake	‡90
Inspiration Con.	39
International Nickel	25⅛
Kennecott	29
Lackawanna Steel	72⅛
Miami Copper	25⅛
Nat'l Lead, com.	39⅛
National Lead, pf.	98⅛
Nev. Consol.	16⅛
Ontario Min.	5⅛
Quicksilver	‡.50
Quicksilver, pf.	‡7
Ray Con	20⅛
Republic I.&S., com.	72⅛
Republic I. & S., pf.	89
Sloss-Sheffield	35
Tennessee C. & C.	12
U. S. Steel, com.	82⅛
U. S. Steel, pf.	105
Utah Copper	71⅛
Va. Iron C. & C.	50

N. Y. CURB†	Dec. 18
Big Ledge	1⅛
Butte & N. Y.	.75
Butte C. & Z.	6⅛
Butte Detroit	.25
Caledonia	.46
Calumet & Jerome	1
Can. Cop. Corpn.	1⅛
Carlisle	2
Cashboy	.04
Con. Ariz. Sm.	1 1/16
Con. Coppermines	6⅛
Con. Nev.-Utah	1/16
Emma Con.	1/16
First Nat. Cop.	1⅛
Goldfield Con.	⅛
Goldfield Merger	.03⅛
Greenmonster	.50
Hecla Min.	4 11/16
Howe Sound	3⅛
Jerome Verde	⅛
Kerr Lake	4⅛
Louisiana	.50
Magma	37⅛
Majestic	.32
McKinley-Dar-Sa.	.59
Milford	1⅛
Mohican	1/16
Mother Lode	.28
N. Y. & Hond.	12
Nipissing Mines	8⅛
Nixon Nevada	1⅛
Ohio Cop.	.75
Ray Hercules	3⅛
Richmond	‡.56
Rochester Mines	.35
St. Joseph Lead	14⅛
Standard S. L.	1/16
Stewart	.25
Success	.09
Tonopah	4⅛
Tonopah Ex.	1.15⅛
Tribullion	⅛
Troy Arizona	.15
United Cop.	.50
United Verde Ext.	34⅛
United Zinc	1⅛
Utica Mines	.12
Yukon Gold	1⅛

SAN FRAN.*	Dec. 18
Alta	.03
Andes	.07
Best & Belcher	.02
Bullion	.01
Caledonia	.05
Challenge Con.	.04
Confidence	‡.06
Con. Virginia	‡.17
Gould & Curry	.01
Hale & Norcross	.02
Jacket-Cr. Pt.	.08
Mexican	.14
Occidental	‡.60
Ophir	.06
Overman	.04
Savage	.03
Sierra Nevada	.13
Union Con.	1.02⅛
Utah Con.	.01
Belmont	3.00
Jim Butler	.70
MacNamara	.16
Midway	.05
Mont.-Tonopah	.10
North Star	.05
Rescue Eula	.08
West End Con.	.68
Atlanta	.07
Booth	.03
Comb. Frac.	‡.03
D'field Daisy	‡.02
Florence	.09
Jumbo Extension	.13
Kewanas	.04
Nevada Hills	.05
Nevada Packard	.15
Round Mountain	.20
Silver Pick	.04
White Caps	.51
Big Jim	‡.75
United Eastern	3.62⅛

BOSTON EXCH.*	Dec. 18
Adventure	1
Ahmeek	71
Algomah	.25
Allouez	46⅛
Ariz. Com., ctfs.	9⅛
Arnold	.20
Bonanza	.21
Butte-Balaklava	.35
Calumet & Ariz.	56
Calumet & Hecla	415
Centennial	12
Copper Range	40⅛
Daly West	1⅛
Davis-Daly	4⅛
East Butte	8⅛
Franklin	4⅛
Granby	64
Hancock	7⅛
Hedley	‡15⅛
Helvetia	.25
Indiana	.75
Isle Royale	20
Keweenaw	1⅛
Lake	5
La Salle	1⅛
Mason Valley	4
Mass	5⅛
Mayflower	.75
Michigan	1⅛
Mohawk	58⅛
New Arcadian	1⅛
New Idria	13
North Butte	12⅛
North Lake	.50
Ojibway	.75
Old Dominion	37
Osceola	55
Quincy	61
St. Mary's M. L.	49
Santa Fe	.60
Seneca	6
Shannon	5⅛
Shattuck-Ariz.	15
So. Lake	1 1/16
So. Utah	.05
Superior	3⅛
Superior & Bost.	2⅛
Trinity	3⅛
Tuolumne	1⅛
U. S. Smelting	42⅛
U. S. Smelt'g, pf.	44
Utah Apex	2
Utah Con.	9⅞
Utah Metal	2⅛
Victoria	2
Winona	1
Wolverine	30⅛
Wyandot	.50

BOSTON CURB*	Dec. 18
Alaska Mines Corp.	.25
Bingham Mines	9⅛
Boston Ely	.60
Boston & Mont.	.40
Butte & Lon'n Dev.	.13
Calaveras	1
Calumet-Corbin	‡.01
Chief Con.	1 1/16
Cortez	.10
Crown Reserve	.20
Crystal Cop.	.45
Eagle & Blue Bell	2
Gila Copper	17
Houghton Copper	.60
Intermountain	.80
Iron Cap, Com.	13⅛
Iron Cap Cop., pf.	‡14⅛
Mexican Metals	.27
Mines of America	1⅛
Mojave Tungsten	.24
Nat. Zinc & Lead	.28
Nevada-Douglas	1⅛
New Baltic	.80
New Cornelia	13⅛
Oneco	.25
Pacific Mines	‡.35
Rex Cons.	.10

SALT LAKE*	Dec. 18
Bannack	.26
Big Four	‡.01
Cardiff	2.50
Colorado Mining	.06
Daly	1.00
Daly-Judge	6.50
Empire Copper	1.17
Gold Chain	.14
Grand Central	.58
Iron Blossom	.60
Lower Mammoth	.03
May Day	.01
Moscow	.11
Prince Con.	.51
Rico Wellington	.18
Silver-King Coal'n	2.25
Silver King Con.	2.60
Sioux Con.	.02
So. Hecla	.70
Tintic Standard	1.45
Uncle Sam	.02
Wilbert	.17
Yankee	.02

TORONTO*	Dec. 18
Adanac	.10
Bailey	.05
Beaver Con.	.25
Chambers Ferland	.10
Coniagas	3.00
Hargraves	.08
La Rose	.43
Peterson Lake	.09
Temiskaming	.27
Wettlaufer-Lor.	.04
Davidson	.28
Dome Exten.	.09
Dome Lake	.13
Hollinger	4.90
McIntyre	1.37
Newray	.39
Porcu. Crown	.23
Teck-Hughes	.25
Vipond	.19
West Dome	.13

STOCK QUOTATIONS—Continued

COLO. SPRINGS	Dec. 18
Cresson Con.	4.37⅛
Doctor Jack Pot	.03⅛
Elkton Con.	.03⅛
El Paso	.12
Gold Sovereign	.02⅛
Golden Cycle	1.46
Granite	.43
Isabella	.07⅛
Mary McKinney	.06
Portland	1.15
United Gold M.	.14⅛
Vindicator	.35

LONDON	Dec. 3
Alaska Tre'dwell	‡£1 0s 0d
Burma Corp.	3 1 7 6
Cam & Motor	0 11 0
Camp Bird	0 7 0
El Oro	0 8 9
Esperanza	0 8 3
Mexican Mines	5 18 9
Min. Corp. Can.	0 17 0
Nechi, pfd.	0 9 9
Oroville	0 19 6
Santa Gert'dis.	0 13 0
Tomboy	1 0 9

* Bid prices. † Closing prices. ‡ Last Quotations.

MONTHLY AVERAGE PRICES OF METALS

Silver	New York			London		
	1915	1916	1917	1915	1916	1917
Jan.	48.855	56.775	75.630	22.731	26.960	36.682
Feb.	48.477	56.755	77.585	22.753	26.975	37.742
Mar.	50.241	57.935	73.861	23.708	27.597	36.410
April	50.250	64.415	73.875	23.709	30.662	36.963
May	49.915	74.269	74.745	23.570	35.477	37.940
June	49.034	65.024	76.971	23.267	31.060	39.065
July	47.519	62.940	79.010	22.597	30.000	40.110
Aug.	47.163	66.083	85.407	22.780	31.498	43.418
Sept.	48.680	68.515	100.740	23.591	32.584	50.920
Oct.	49.385	67.855	87.332	23.925	32.361	44.324
Nov.	51.714	71.604	85.891	25.094	34.192	43.584
Dec.	54.971	75.765		26.373	36.410	
Year	49.684	65.661		23.675	31.315	

New York quotations cents per ounce troy, fine silver; London, pence per ounce, sterling silver, 0.925 fine.

Copper	New York		London			
	Electrolytic		Standard		Electrolytic	
	1916	1917	1916	1917	1916	1917
Jan.	24.008	28.673	88.083	131.921	116.167	142.895
Feb.	26.440	31.750	102.667	137.895	133.167	148.100
Mar.	26.310	31.481	107.714	136.750	136.000	151.000
April	27.895	27.935	124.319	133.842	137.389	147.158
May	28.625	28.788	135.457	130.000	152.522	142.000
June	26.601	29.962	112.432	130.000	137.455	142.000
July	23.865	26.620	95.119	128.409	125.500	140.409
Aug.	26.120	25.380	110.283	122.391	126.304	137.000
Sept.	26.855	25.073	113.905	117.500	134.071	135.250
Oct.	27.193	23.500	122.750	110.000	142.523	125.000
Nov.	30.625	23.500	134.659	110.000	155.432	125.000
Dec.	31.890		145.316		162.842	
Year	27.202		116.059		138.281	

Tin	New York		London	
	1916	1917	1916	1917
January	41.825	44.175	175.548	185.813
February	42.717	51.420	181.107	198.974
March	50.741	54.388	193.609	207.443
April	51.230	55.910	199.736	220.171
May	49.125	63.173	196.511	245.114
June	42.231	62.053	179.466	242.083
July	38.510	62.570	168.357	242.181
August	38.565	62.681	169.870	243.978
September	38.830	61.542	171.345	244.038
October	41.241	61.851	179.307	247.467
November	44.109	74.740	186.932	274.943
December	42.635		183.368	
Av. year	43.480		182.096	

Lead	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
January	5.921	7.626	5.826	7.530	31.167	30.500
February	6.246	8.636	6.164	8.595	31.988	30.500
March	7.136	9.199	7.375	9.120	34.440	30.500
April	7.630	9.288	7.655	9.158	34.368	30.500
May	7.463	10.207	7.332	10.202	32.967	30.500
June	6.936	11.171	6.749	11.123	31.011	30.500
July	6.352	10.710	6.185	10.644	28.137	30.500
August	6.244	10.594	6.088	10.518	29.734	30.500
September	6.810	8.680	6.699	8.611	30.786	30.500
October	7.000	6.710	6.898	6.650	30.716	30.500
November	7.042	6.249	6.945	6.187	30.500	30.500
December	7.513		7.405		30.500	
Year	6.858		6.777		31.359	

Spelter	New York		St. Louis		London	
	1916	1917	1916	1917	1916	1917
Jan.	16.915	9.619	16.745	9.449	89.810	48.329
Feb.	18.420	10.045	18.260	9.875	97.762	47.000
Mar.	16.846	10.300	16.676	10.130	95.048	47.000
April	16.695	9.459	16.525	9.289	99.056	54.632
May	14.276	9.362	14.106	9.192	94.217	54.000
June	11.752	9.371	11.582	9.201	68.591	54.000
July	8.925	8.643	8.755	8.473	50.750	54.000
Aug.	8.730	8.360	8.560	8.190	51.587	54.000
Sept.	8.990	8.136	8.820	7.966	52.095	54.000
Oct.	9.829	7.983	9.659	7.813	54.159	54.000
Nov.	11.592	7.847	11.422	7.672	56.023	54.000
Dec.	10.665		10.495		55.842	
Year	12.804		12.634		72.071	

New York and St. Louis quotations, cents per pound, London, pounds sterling per long ton.

Pig Iron, Pgh.	Bessemer‡		Basic‡		No. 2 Foundry	
	1916	1917	1916	1917	1916	1917
January	$21.60	$35.95	$18.78	$30.95	$19.70	$30.95
February	21.16	36.37	18.93	30.95	19.51	30.95
March	21.81	37.37	19.20	33.49	19.45	35.91
April	21.65	42.23	18.95	38.90	19.45	40.06
May	21.78	46.94	19.11	42.84	19.58	43.60
June	21.95	54.22	18.95	50.05	19.34	50.14
July	21.95	57.45	18.95	53.80	19.20	53.95
August	21.95	54.17	18.95	50.37	19.22	53.96
September	22.88	46.40	19.58	42.24	19.53	48.58
October	24.61	37.25	21.26	33.95	21.51	33.95
November	30.07	37.25	28.18	33.95	26.55	33.95
December	35.16		30.95		30.79	
Year	$23.88		$20.98		$21.15	

‡ As reported by W. P. Snyder & Co.